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## ATTACKS ON HEALTHCARE WORKERS: LEGAL SCENARIO IN INDIA



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**Case history:** In a recent Public Interest Litigation (PIL), before Division Bench of Guwahati High Court concern has been raised about the doctors and paramedics, who are the frontline warriors and it also touches on an incident where a Doctor was manhandled and beaten up by a mob in Udali Model Hospital in the district of Hojai. Further prayer in this petition is that suitable measures be taken by the State to ensure that such incidents do not occur in future. The Ld. Advocate General of the State of Assam, Mr. D. Saikia has apprised the Division Bench that as far as the incident of Udali is concerned, the concerned persons, twenty-four in number, were arrested within twenty-four hours and are presently lodged in jail and due process of law is being followed as far as this incident is concerned. Moreover, the State Government itself is conscious about the care it has to give to its doctors and paramedics and it is open for any suggestions and guidelines in this regard as it is a public interest litigation. Let a statement of progress made in this case be placed before this Court within two weeks from now.

### COURT JUDGEMENT

*Sudhanshu Dhulia, J, Manash Ranjan Pathak, J. Guwahati, Assam vs. IN RE- The Principal Secretary to The Govt. of Assam and 3 Ors., GAHC010092512021. Date of Judgment: 11.06.2021, 14.07.2021. Gauhati High Court.*

Meanwhile, a detail reply be filed by the Government of Assam within two weeks with regard to the measures taken by the Government or the measures it proposes to take to ensure that such incidents do not happen in future and that with immediate effect it should be ensured that no weapon/firearms are allowed to be taken inside a hospital and proper notice of warning is given in every hospital and medical colleges about the consequences to be followed in law if Medicare Service Persons, which include Doctors, Nurses, Para-medical, medical students, nursing students and any other worker employed and working in Medicare Service Institutions [as defined under Assam Medicare Service Persons and Medicare Service Institutions (Prevention of Violence and Damage to Property) Act, 2011], are manhandled or attacked. Act received the assent of the President of India on 22<sup>nd</sup> January, 2013, and Gazette Notification vide No. LGL.92/2011/18, dated: 4<sup>th</sup> February, 2013 brought for awareness in public domain. As per the Preamble an Act to prohibit violence against Medicare Service Persons and damage to Property of Medicare Service Institutions in the State of Assam and for matters connected therewith and incidental thereto. Whereas it is expedient to prohibit violence against Medicare Service Persons and damage to Property of Medicare Service Institutions in the State of Assam and matters connected therewith or incidental thereto; Act defines Medicare Service, Medicare Service Institutions and Medicare Service Persons, Violence and Property of Medicare Service Institution along with penal provisions, fine and recovery of compensation from perpetrator of violence, but there appears to be no deterrence among general public.

### **Under Sec. 3. Offences against Medicare Service Persons and Medicare Service Institutions:**

Following acts by any members of the public shall be an offence for the purposes of this Act:- (a) Violence against any Medicare Service Person; (b) Damage to any property of the Medicare Service Institution or to any Medicare Service Person. Whoever commits any offence as defined in section 3 shall be punished with imprisonment for a term which may extend to three years and with fine which may extend to fifty thousand rupees. Any offence punishable under section 3, shall be cognizable and non-bailable.

- (1) In addition to the punishment provided in section 3, the Court shall, when passing judgement, order the accused person to pay, by way of compensation, such amount as may be specified in the order for the damage or loss caused to the Property of the Medicare Service Institutions: Provided that in case of damage or loss caused to any Property of Medicare Service Institution, the quantum of compensation shall not be less than the amount of purchase price of such property;
- (2) Where the order of compensation made under sub-section (1) is not paid, the same shall be recovered under the provisions of the Bengal Public Demands Recovery Act, 1913 from the accused person as if it were an arrear of land revenue. The provisions of this Act shall be in addition to and not in derogation of the provisions of any other law, for the time being in force.

**Expert Comment:** It is expected from the State Government of Assam in this case and other state governments and Union Government to ensure protection of health care workers in future by giving wide publicity of statutory provisions existing in their State for protection of HCW and instill confidence to work fearlessly to save the life of needy common persons approaching hospitals. Govt. should adopt "Zero Tolerance Policy" on the issue of violence against HCWs, which is only possible through certainty of punishment in time bound manner. It is expected from the Govt. to bring before the Hon'ble High Court concrete plan for protection of HCWs and provide adequate budgetary support for installation of CCTV Cameras in all sensitive areas of hospital premises and remove shortcomings in terms of infrastructure, manpower and equipment.

**Cite this case law as:** Yadav Mukesh. Attacks on healthcare workers: Legal Scenario in India. *Int J Health Res Medico Leg Prae* 2021 Jan-Jun;7(1):6.





## EDITORIAL



# Opting life-saving measures to younger or the elder in the critical care centre amid covid pandemic crisis: the ethical and legal dilemma

**Mahanta Putul**

*The dreadful pandemic of Covid-19 has wrecked the worldwide population. Furthermore, the pandemic has initiated an unprecedented admission of ailing cases in the Intensive Care Unit (ICU) or Critical Care Centre (CCC), raising various ethical conflict relating to the Triage, removing life-saving supports and providing end-of-life care. Besides, the moral and ethical quandary has also increased manifold while communicating with patients and family members, including informed consent and informed refusal to the suggested treatment procedures. The acknowledgement of massive acute respiratory distress syndrome (ARDS) cases in serious form surprisingly surpassing the bed availability at the CCC in most parts of several countries. Due to this fact, four novel choices never used before were well-thought-out with the primary objective in reduction of fatality of the cases as much as possible, viz., (i) to line up the maximum number of bed at CCC for cases with the excellent outcome; (ii) to raise the number of economic bed at CCC; (iii) to arrange to shift to distant centres with more beds availability and (iv) reduction of ICU stay and the removal of life-saving measures. The hospital visit by the family members was also banned to save them from the infection. Thus, India has taken unprecedented and stern preventive measures against Covid-19 to control its spread to protect its citizens. However, as a prime component of the healthcare system, the treating physicians face a substantial legal and ethical dilemma while dealing with many patient's influxes at the CCC worldwide.*

## BACKGROUND

The caregivers face an ethical and legal quandary over-allocating the facilities to disproportionately raised critically ill patients because of the scarcity of human resources, ICU beds, oxygen supply, and other life-saving measures, as shown in **Table 1**. Preventing attendant's visit to hospital has also complicated further the decades-old research outcome to improve communication with families and caregivers during this crucial period.<sup>1</sup>

**Table 1** Dilemmas in patient selection

Sl No	Admission to Intensive Care Unit (ICU)
1	Those patients of a young wage earner or senior citizens?
2	Those patients with the excellent outcome with the current illness?
3	The patient who most likely to survive for a prolonged period considering their preexisting illness?

Considering the above dilemmas, can a physician make their own choices? Then, with a bit of time in hand, the physicians make a life-saving decision to save ARDS patients based on different guidelines.

The different hospital follows different guidelines in other countries. Some hospital authorities favour saving youngsters than the elders,<sup>2</sup> though ethically and legally it is challenging. Also, the conflicts come while the physicians are to consider some of the patient's wishes or Advance Medical Directive (AMD) at the patient's end phase of life, as shown in **Table 2**.

However, real-life scenarios are more challenging and painful. Many physicians argue that age should be considered as a condition for the ICU bed besides the severity of the disease. The physician feels sad for those youngsters with serious ARDS though they never deny the bed for the elderly. The scene is completely different inside the ICU, yet extraordinarily complex to favour the younger over the aged. The physician prefers the young bread-earner whose outcome is expected

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**Table 2** Aspect that should be looked for at the time of decision making

Sl No	Related to patients
1	Wishes or orders of patients, viz., "Don't resuscitate", "Don't intubate", and "Allow natural death" when their vital organs stop
2	Withdrawal of life supports from those whose vital organ has stopped to give a chance to others who are waiting for the revival
3	Advance medical directives
4	With severe comorbidities
5	Prognosis of acute illness and expected outcomes
6	The poor condition of Livingood
7	Fatality Scores
	<b>Related to legal caretakers</b>
1	Communication difficulties, including informed consent and informed refusal
2	Witness to patient's wishes
3	Interdisciplinary decision-making procedure, its documentation, and family consent
4	Documentation of medical record

over the aged one who may not survive.<sup>2</sup> In a life-threatening condition, a grave decision must be express by the patient or attendant about the intensive resuscitation process in the event of a stoppage of their vital organs as quality relief becomes the aim of care.<sup>3</sup>

During the hospital stay, many of them express their willingness about Don't Resuscitate (DNR), Don't Intubate (DNI) and Allow Natural Death (AND). In the above circumstances, the treating physician must consider all the standing legal constraint and their validity. In addition, the family members must be asked if the patient has advance directives (ADS).

The Indian scenario has lots of legal restriction about life-prolonging and end-of-life care measures.<sup>3</sup> All those issues come into play if any such actions are taken in active or impending cardiorespiratory arrest cases. In medical waffle, allowing all such measures are considered "full code," while an order not to make any such procedures<sup>3</sup> is known as a DNR wishes. These discussions are often done between severely ill patients and first-time attending physician. An open and accessible discussion on the patient's standpoint on his life, disease and procedures should be undertaken. If a patient's vital parameter deteriorates, a critical choice about actual end-of-life care may follow.<sup>2</sup>

The different voluntary choices of the patients for ending their life are associated with legal issues, and they need better

empathetic comprehension and clear communications. Therefore, this editorial explored the different ethical and legal queries and their practical applicability in the Indian context amid the covid pandemic crisis.

### Application of DNR wishes

In DNR instruction of the patient, cardiopulmonary resuscitation (CPR) is not given while a patient suffers from a cardiorespiratory arrest. The whole procedures must be well recorded and is a recognized concept in many advanced countries. Here, nearly 15% of patients with DNR orders have undergone surgical procedures, including tracheostomy, gastrostomy, and central venous catheter insertion.<sup>4</sup>

The capable ill person or legal caretaker usually makes such orders for withdrawing precise resuscitative measures in need. Healthcare providers need to initiate strategies to handle DNR orders in anaesthesia and surgery.<sup>5</sup> The acceptance of DNR orders increases because the people are well informed about the Patient Self-Determination Act and advanced directives.<sup>6</sup>

### Application of DNI wishes

The term DNR and DNI have different choices. While a patient requests a DNR choice, the doctor must ask whether they want a DNI wish. For example, a patient may have breathing distress before the failure of the cardiovascular system. In this condition, the breathing tube is not given, but CPR may be initiated. If the breathing difficulties continue, the heart or lungs may go into full arrest. In that sense, intubation, however, may avert the arrest of lung and heart.

### Application of wishes of "AND"

The term "AND" is applicable while only the pain-relieving measures are taken to get rid of pain and other symptoms. The interventions may be withdrawing resuscitation measures, nutrition supplementation, intravenous fluids, and the medications prolonging the death. The process of natural death should not be intervened. Here the only effort is made to make the patient death process relaxed and peaceable.<sup>7</sup>

The DNR process is a kind of passive mercy killing experienced in most areas of the world without any legal issues.<sup>8</sup> But the term assisted suicide and physician-assisted suicide is not the same as that of mercy killing.<sup>9</sup> Active mercy killing and physician-assisted suicide are prohibited in many countries, except Switzerland and the Netherlands. But many politicians and support groups for patient pressurizing to sanction this practice around Europe affect many parts of the world.<sup>10</sup>

Professional honesty is to be maintained to avoid moral conflict. In addition, distributive justice is to be served. An open discussion of options, resources, and outcomes should follow with the patient and attendant as adopted by the American College of Surgeons.<sup>11</sup> These provide a fundamental base to create strategies to address perioperative DNR orders.



## INDIAN PERSPECTIVE

In India, the practice of DNR wishes yet to be legalized. As a result, the stately manner of living and dying has not been widely reviewed in the judiciary.

In many aspects of end-of-life care, the Indian laws are vague. The hospital expenditures of the ailing patient also play a vital role in continuing any such expensive life-prolonging procedures. In many such situations, the patient itself or their relative is to bear all such bill.<sup>12</sup>

Practicing many such existing guidelines regarding end-of-life care is not allowed in India. Even the Hon'ble Courts of India has debated for decades to admit passive euthanasia using the removal of life-support to Aruna Shanbaug, who was in a state of permanent vegetative state for more than 37 years at King Edward Memorial Hospital.<sup>13</sup> Some strategies have been proposed recently to off-putting life-prolonging interferences and providing quality care at the end of life in Indian critical care centres.<sup>14</sup>

However, the Hon'ble Supreme Court of India, on 2018 March 9, has legalized passive euthanasia in a landmark verdict, permitting 'living will' by patients on diminishing life-saving measures if they go to a state of irreversible coma.<sup>12</sup> This legalization of passive euthanasia in India has recognized that a terminally ill patient or a person in PVS can execute an "advance medical directive" or a "living will" to deny life-prolonging measures.

At times, many queries have been raised on these issues. However, many agree to the right to choose to die of the terminally ill patient, but what if the right becomes an obligation. Indian law has not given such right to end their life, so they cannot ask their doctor to stop the medication. Therefore, there is a possibility of abusing such privileges.

Many support the patient's rights. However, does this mean that we need a 'right to die' law? This subject is more legal than ethical which need extensive judicial scrutiny.

The Indian Penal Code (IPC) has covered all the issues of PAS and euthanasia. According to IPC 1860, active euthanasia is an offence under Section 302 (punishment for murder) or Section 304 (sentence for culpable homicide not amounting to murder).

Many such related issues of end-of-life care are confusing and vague in the eyes of the law, which has recently caught the interest of social media, including politicians. They argue that the treating institutes give less courtesy to those patients' wishes, especially when they face the end-of-life. Those issues will be changed only when the new laws come up legalizing active euthanasia.

Even the Hon'ble Court has intervened to manage critically ill covid patients at the CCC in recent times. The Hon'ble Supreme Court has recently taken up Suo-Moto cases and PILs from various High courts. This judicial discussion

summarizes that State Government would issue guidelines so that relatives should not pressurize doctors to use Remdesivir for their relatives and doctors utilize it judiciously. The state government needs to streamline the drug distribution, and the central government ensures supply as per quota. Thus, the state government has issued guidelines for the ridiculous use and distribution of facilities equally to patients admitted in the ICU.<sup>2</sup> Some physicians have raised questions about equal distribution of the facilities as there is a vast individual variation like age, comorbidities, disease severity, duration of illness, etc. Many treating physicians feel insecure as the doctor services are not out of legal scrutiny and litigations. Physicians have to work with the available resources with several unanswered worries, as stated in **Table 3**.

**Table 3** Queries arises at the time of choosing treatment procedures/guidelines

Query	Doctor's worries:
1	Is it mandatory to follow the available protocol or guidelines laid down by the Govt. authority in treating the individual patient?
2	What happens if doctors follow protocol, and the patient dies? Would court or state save them from charges of negligence?
3	What if doctors do not follow protocol and the patient survives? Would allegation of overtreatment and overcharging stand judicial scrutiny?
4	Many other guidelines regarding its management are available, which can be combined. Should a PIL be filed in this regard? If so, by whom?
5	Do doctors have any immunity for alleged negligence during a pandemic or natural calamity?

Standard operative procedures (SOP) are needed to manage acute cases during the pandemic crisis. There are different protocols and SOPs for various institutes, states, and countries. Some of them are diagonally opposite, and doctors follow some protocol or others in their practice. The treating physicians are bound to follow them. In death cases, deformities and other adverse outcomes, the patients or relatives may hold the treating physicians negligent. They may even file PIL or litigate the doctor under the consumer forum, civil and criminal courts, the human right commission, and the National Medical Commission (NMC) in India. In many situations, the courts have awarded compensation and even punishments to the treating physicians.

Therefore, while the Hon'ble Courts pass any such order giving SOPs or protocol or guidelines for managing the patients, it should also clarify that they will not be negligent

in adverse outcomes if the doctors treat patients as per protocols.

In a situation, while a patient survives, usually, there will make no litigation case. But the doctor has to justify deviating from the SOPs, like a patient not responding to management as per the SOPs. Thus, despite the excellent defence, the treating physicians are harassed by the system though proved innocent in the end. This is a kind of professional hazard the medical fraternity faced. However, the management of this Covid-19 pandemic is well covered under the Disaster Management Act 2005.

### NOT THE AGE BUT THE DISEASE SEVERITY A CRITERION FOR ICU BED

Hardly few CCC have the facility for extracorporeal membrane oxygenation (ECMO) therapy for prolonging heart-lung support to that patient whose both vital organs fail to function. A physician in a leading newspaper said that a 44-year-old man shows a steady improvement on ECMO for >3 weeks. He also stated how he witnessed one young lady dying in his front due to the lack of ECMO machines support as the lone machine supporting another elderly by this time. The doctor feels helpless other than gaining stress. He said each lost life would have been saved.<sup>2</sup>

Many factors, including the patient's age and personage (V.I.P.) background, are also a matter as the doctor receives numerous calls from influential personalities. Many Non-Governmental Voluntary Organization (NGOs) have been working worldwide to help needy patients get a bed. A worker working under NGO said his struggling fact to provide a patient with an ICU bed on April 30, 2021. The patient has lost his parents the previous day, and his pregnant wife had gone for their funeral. Several political leaders and influential officers intervened on his request to give him an ICU bed.<sup>2</sup>

While facing the "once in a lifetime crisis", the physician met in the patient management were often found guardless and guard off. The critical care specialists were also caught off guard, forced to overwork. The lack of human resources, immediately non-availability of CCC beds, and their inability to transfer patients to another centre make the experience more painful, contrary to their basic ethical principles and source of immediate burden.<sup>15-17</sup>

Despite many moral, ethical, and legal difficulties, majority treating physicians look forward with an empathic attitude. They feel disease severity as a criterion, not the age for selecting the ICU bed because of the hospital's colossal rush demanding ICU bed. Based on the same criteria, all the life-saving measures should be continued.

In conclusion, the Ethical Principles of Justice is applicable in such situations. The assignment of degrees of urgency to illnesses to decide the order of treatment to many patients (Triage) is an accepted procedure in a mass disaster or pandemic on the principle of justice that every physician has

to follow is the golden rule to avoid any legal hurdles. We need to rationalize triage policies in conjunction with ethical justifications. More importantly, the whole triage process needs to be documented.

### REFERENCES

- Davidson JE, Aslakson RA, Long AC, Puntillo KA, Kross EK, Hart J, et al. Guidelines for family-centred care in the neonatal, pediatric, and adult ICU. *Crit Care Med* 2017;45(1):103-28. doi: 10.1097/CCM. 00000000000002169.
- Doctors' ethical dilemma: save the young or seniors? Times of India 2021 May 11; Available from: URL:[http://timesofindia.indiatimes.com/articleshow/82539363.cms?utm\\_source=contentofinterest&utm\\_medium=text&utm\\_campaign=cppst](http://timesofindia.indiatimes.com/articleshow/82539363.cms?utm_source=contentofinterest&utm_medium=text&utm_campaign=cppst)
- Mahanta Putul, Thakuria KD. End of life care: 'do not resuscitate', 'do not intubate' and 'allow natural death' ethical dilemmas. *Indian Internet J Forensic Medicine Toxicology* 2019 Jan-March;17(1):1-4.
- Truog RD. "Do-not-resuscitate" orders during anaesthesia and surgery. *Anaesthesiology* 1991;74:606-8. doi: 10.1097/0000542-199103000-00030.
- La Puma J, Silverstein MD, Stocking CB. Life-sustaining treatment: a prospective study of patients with DNR orders in a teaching hospital. *Arch Intern Med* 1988;148:2193-8. doi:10.1001/archinte. 1988.00380100067015.
- Omnibus Budget Reconciliation Act of 1990. Title IV, Section 4206. *Congressional Record*, Oct. 26 1990;136:H12456-7.
- Curesearch for children's cancer. DNR/DNI/AND. [cited 2018 June 20]; Available from: URL:<https://curesearch.org/DNR-DNI-AND>
- British Broadcasting Corporation. Ethics Guide. Euthanasia. 2014. [cited on 2018 June 20]; Available from: URL:<http://www.bbc.co.uk/ethics/euthanasia/overview/introduction.shtml>
- Chao DV, Chan NY, Chan WY. Euthanasia revisited. *Fam Pract* 2002;19:128-34.
- Farooq Khan, George Tadros. Physician-assisted suicide and euthanasia in Indian context: sooner or later, the need to ponder! *Indian J Psychol Med* 2013 Jan-Mar;35(1):101-105.
- Fine PG. DNR in the OR—anesthesiologists, medical ethics, and guidelines. *ASA Newsletter* 1994;58:10-4.
- Mani RK. Limitation of life support in the ICU: ethical issues relating to end of life care. *Indian J Crit Care Med* 2003;7:112-7.



13. Mahanta Putul. Euthanasia: dying with dignity. The Assam Tribune 2018 March 14;editorial:6.
14. Mani RK, Amin P, Chawla R, Divatia JV, Kapadia F, Khilnani P, et al. Limiting life-prolonging interventions and providing palliative care towards the end of life in Indian intensive care units. Indian J Crit Care Med 2005;9:96-107.
15. White DB, Lo B. A framework for rationing ventilators and critical care beds during the COVID-19 pandemic. JAMA 2020;323:1773–4.
16. Maves RC, Downar J, Dichter JR, Hick JL, Devereaux A, Geiling JA, et al. Triage of scarce critical care resources in COVID-19 an implementation guide for regional allocation. Chest 2020. [cited 2021 June 15]. Available from: URL:<https://doi.org/10.1016/j.chest.2020.03.063>
17. Lai J, Ma S, Wang Y, Cai Z, Hu J, Wei N, et al. Factors associated with mental health outcomes among health care workers exposed to coronavirus disease 2019. JAMA Netw Open 2020;3(3):e203976.

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### RESEARCH PAPER

# Ultrasound-guided serratus anterior plane block for post-thoracotomy pain

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**Background and aims:** Thoracotomy is widely recognized as one of the most painful surgical procedures. This form of intensified pain is a matter of high concern to prevent pulmonary complications. Opiates and other weaker analgesics are not sufficiently effective in controlling post-thoracotomy pain. Now, presently there has been an increased interest in the use of regional nerve block. Serratus Anterior Plane Block (USG SAPB) is an interfascial block providing paresthesia of T2 to T9 dermatomes of the anterolateral thorax. **Materials and methods:** In this single hospital-based, patient and observer-blinded study, 60 patients scheduled for elective thoracotomy were randomized to receive "USG SAPB" (n=30) with 0.2% Ropivacaine after induction and 20 minutes before incision or Standard control group (n=30) that received standard postoperative pain control with intravenous opioids, NSAIDs and acetaminophen (paracetamol). We compared the postoperative pain assessment, hemodynamic parameters and complications, if any, of both the groups at 2<sup>nd</sup>, 4<sup>th</sup>, 6<sup>th</sup>, 8<sup>th</sup>, 12<sup>th</sup>, 24<sup>th</sup> hours. The statistical analyses were done by using the PSW software version 21.0. Data were compared using the Chi-square test, Unpaired t-test and Mann-Whitney U test. **Results:** The Visual Analogue Scale score was significantly lower in the USG SAPB group than the Standard pain control group at rest and coughing (p<0.001) at 8, 12 and 24th postoperative hours and 6, 8, 12 and 24<sup>th</sup> hours, respectively. The need for rescue analgesia was significantly lower in USG SAPB (p=0.046). The hemodynamic parameters were comparable in both groups. **Conclusion:** The USG SAPB provided prolonged and adequate analgesia and can be used as an adjuvant treatment option for post-thoracotomy.

**Keywords:** Visual analogue score; serratus anterior plane block, complications, rescue analgesia.

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## INTRODUCTION

Thoracotomy is widely recognized as one of the most painful surgical procedures.<sup>1</sup> Post thoracotomy pain (PTP) is

mediated through multiple nociceptive and neuropathic mechanisms, which originate from somatic and visceral afferents.<sup>2</sup> The primary source of pain are intercostal nerves, the vagus nerve and phrenic nerve in the pleura, the superficial



cervical plexus, the brachial plexus in the ipsilateral side.<sup>3</sup> The thoracotomy incision involves cutting through several muscle layers of the chest wall and resection of the ribs.<sup>4</sup> This form of intensified pain is a matter of great concern, and pain relief becomes essential not only for the patient's comfort but also to prevent pulmonary complications.<sup>5</sup> In addition to this, inadequate analgesia may result in delayed mobilization of the Patient with increased chances of deep vein thrombosis and pulmonary embolism.<sup>6</sup> Furthermore, if untreated, acute post-thoracotomy pain may lead to chronic post-thoracotomy pain, which has a severe negative impact on the quality of life.<sup>7</sup>

The most acceptable methods for treating post-thoracotomy pain are opioid and thoracic epidural anaesthesia (TEA), associated with severe side effects. Opiates can cause respiratory depression, frequently requiring reintubation and reventilation, while TEA is technically challenging to perform and has the risk for accidental intravascular injection and pneumothorax. Weaker analgesics, such as NSAIDs, are not effective in controlling severe pain and are also complicated by gastrointestinal bleeding. With the introduction of ultrasound guidance, it has facilitated various plane block to achieve adequate regional anaesthesia. In our present study, we used Ultrasound-guided Serratus Anterior Plane Block (SAPB). SAPB was 1<sup>st</sup> described by Blanco et al.<sup>8</sup> The study's objective was to compare the postoperative pain assessment, hemodynamic parameters and complications, if any, of both the groups at 2<sup>nd</sup>, 4<sup>th</sup>, 6<sup>th</sup>, 8<sup>th</sup>, 12<sup>th</sup>, 24<sup>th</sup> hours.

## MATERIAL AND METHODS

The Institutional Ethics Committee provided ethical approval of this study under the Department of Anaesthesiology and Critical Care, Gauhati Medical College and Hospital, Guwahati, with reference number MC/190/2007/Pt-11/MAR-2019/PG/29. This randomized, Patient and observer-blinded, single hospital study was conducted in the Cardio-Thoracic and Vascular Surgery operation theatre from 1<sup>st</sup> June 2019 to 31<sup>st</sup> January 2020 on the patients aged 18-65 years undergoing elective Thoracotomy with American Society of Anaesthesiologists (ASA) Physical Status class I and II under general anaesthesia. Exclusion criteria were allergy to the study drugs, contraindications to Serratus anterior plane block, systemic infections or patients having local sepsis at the site of injection, Cardiovascular diseases- hypertension (blood pressure more than 140/90), tachycardia, congestive heart failure, and coronary artery disease), chronic obstructive pulmonary disease, renal insufficiency, liver dysfunction, the disorder of homeostasis, patients having chronic pain, redo-Thoracotomy. Written and informed consent was obtained from all the patients.

Based on a previous study,<sup>9</sup> considering the mean (standard deviation) VAS of 2.6 (1.93), to detect a difference of 1.5 in VAS, 26 samples were required in each group with a power

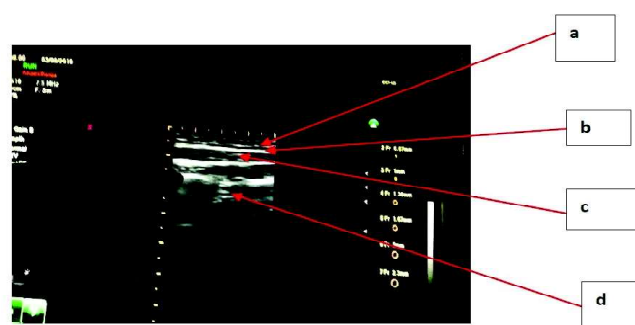
of 80% at the significance level of alpha value 0.05 and confidence interval of 95%. Considering an attrition rate of 15%, 30 patients in each group were required in this study. Thus, a sample size of 60 patients was obtained for the study.

After that, random allocation of patients via a computer-generated random selection was done into two equal groups- Group A (SAPB=30) who received Ultrasound-guided Serratus Plane Block with 0.2% Ropivacaine after induction and 20 mins before skin incision and Group B (Standard control=30) who received postoperative analgesic regime comprising of opioids, NSAIDs and acetaminophen.

General anaesthesia was administered comprising of Inj Fentanyl (1-2 mcg/kg), inj Propofol (2-3 mg/kg), inj Vecuronium bromide (0.08-0.1mg/kg) and maintenance with Sevoflurane at titrated dose. Unilateral postero-lateral thoracotomy was carried out at the space between the 4<sup>th</sup>-5<sup>th</sup> ribs.

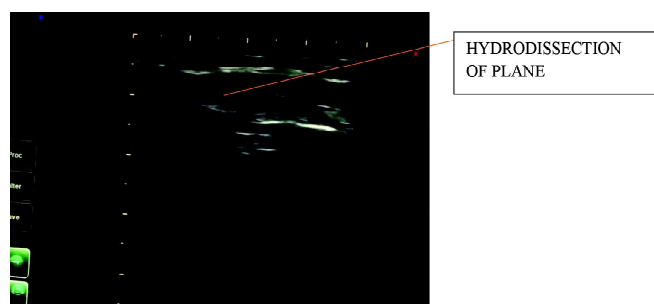
A designated resident, who was not involved in the study, performed the SAPB. Decoding of data was done only after the analysis phase was over.

For SAPB, the Patient was turned laterally with the operative side upwards. Under all aseptic and antiseptic precautions, a -frequency linear probe was placed in a sagittal plane over the patient's midaxillary line at the level between the 4<sup>th</sup> and 5<sup>th</sup> rib. With the rib, pleura and the overlying serratus anterior and latissimus dorsi muscle visualized (**Figure 1**), a 22-gauge 50-mm insulated short bevel needle was advanced in-plane technique at 45 degrees. On reaching the appropriate plane, i.e. the plane between latissimus dorsi above and serratus anterior below, 1-2 ml of normal saline was injected after negative aspiration, and hydro-dissection of fascia was seen for confirmation (**Figure 2**). 20 ml of 0.2% Ropivacaine 3ml/kg was injected into the plane.



**Figure 1** a) Latissimus dorsi muscle b) the plane for drug deposit c) Serratus anterior muscle d) pleura

After the completion of the surgery, patients were assessed at an interval of 2, 4, 6, 8, 12 and 24 postoperative hours, respectively, using a Visual Analogue Scale (VAS: 0cm = no pain and 10cm = worst pain imaginable,<sup>10</sup>) both at rest and during coughing by the attending nurse blinded to the allotment. Duration of analgesia, side effects and



**Figure 2** Ultrasonographic image of the drug spread

complications, if any, were also recorded. Intravenous (i.v) tramadol 50 mg stat was used as rescue analgesic, when VAS >4 or at 'Patient's request, up to a maximum of 3 doses in the first 24 hours postoperatively. Beyond that, intramuscular injection of diclofenac 75 mg was used. The time of administration of the rescue analgesics was noted.

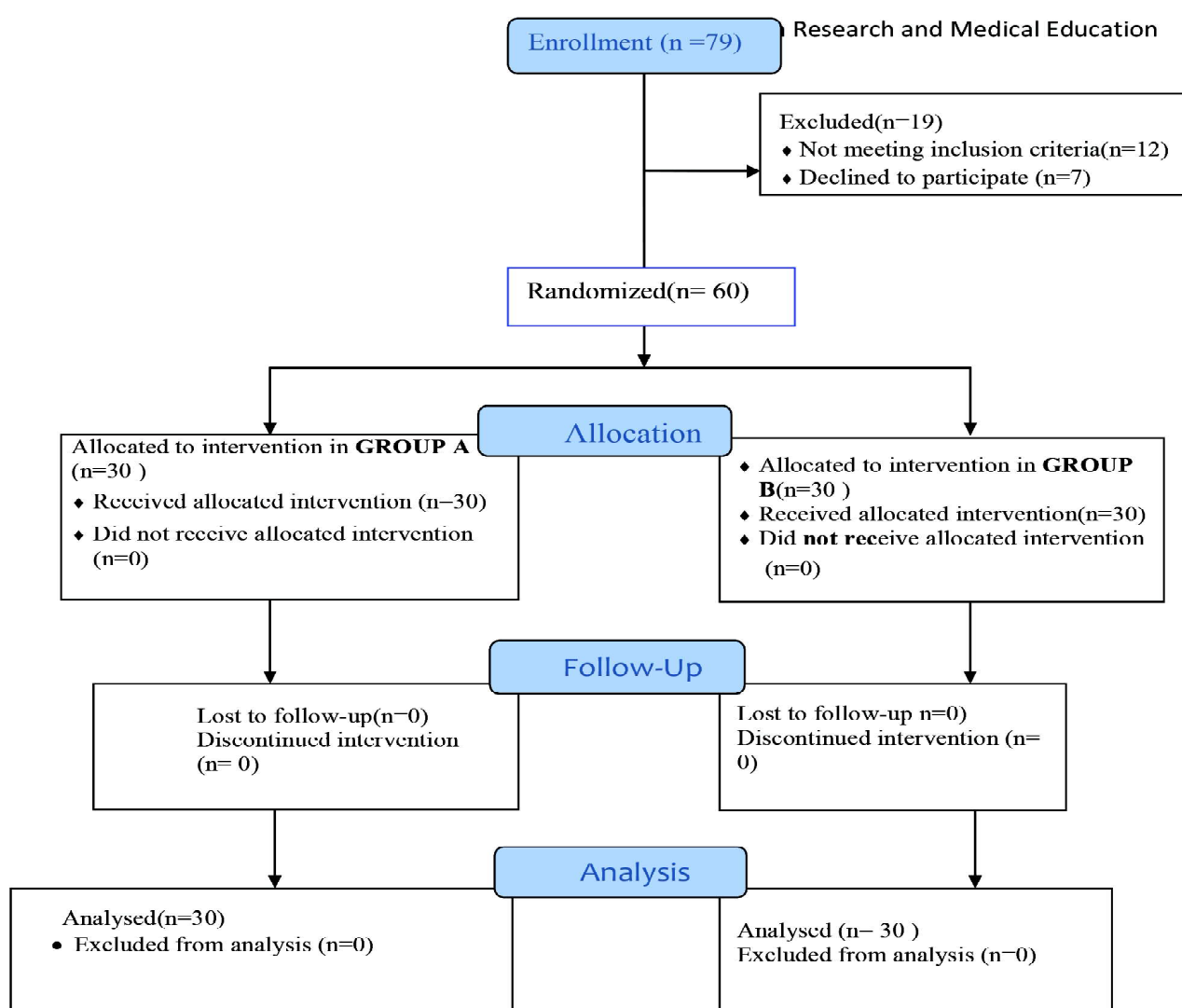
Hemodynamic parameters, including blood pressure, heart rate and respiratory rate, were monitored. Adverse events comprised hypotension, bradycardia, hypoxemia ( $SpO_2 < 90\%$ ) or nausea and vomiting.

The statistical analyses were done by using the PSW software version 21.0.

A Chi-square test was used to evaluate the difference between categorical variables. Data rechecked for normality using Kolmogorov-Smirnova test. Unpaired t-test and alternative non-parametric Mann-Whitney U test were used depending on the normality assumption's fulfilment. Probability if less than 0.05 was considered to be significant.

## RESULTS

The flow of patients in the trial is shown in the Consort flow diagram (**Figure 3**).



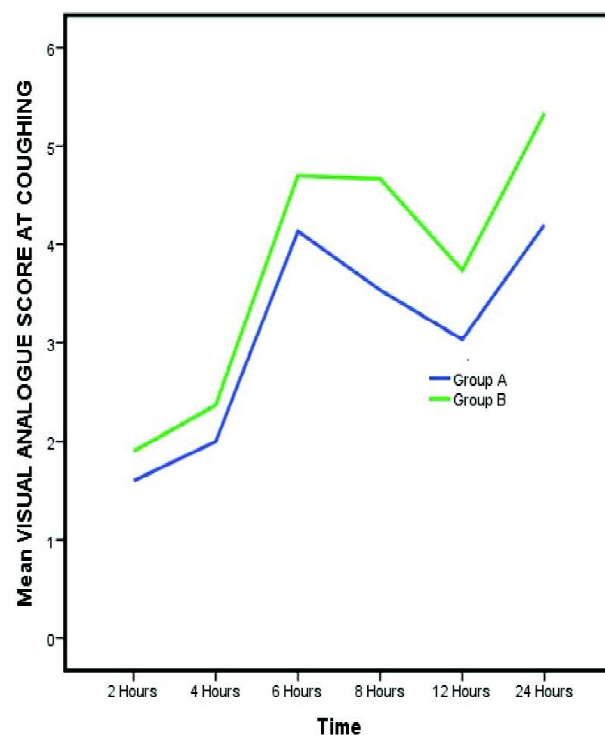
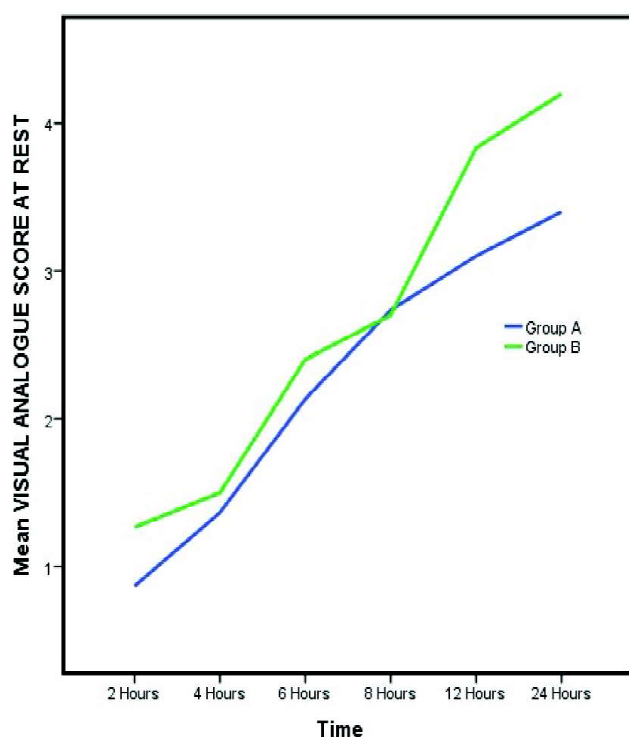
**Figure 3** Consort flow diagram

The patient's demographics (**Table 1**) were similar, with no significant differences among both groups regarding age, weight, gender, height and operative time.

**Table 1** Demographic and other data

Variables		N	Mean	Std. Deviation	Minimum	Maximum	P-value
AGE (years)	Group A	30	38.9	15.193	18	64	0.412
	Group B	30	40.73	11.687	24	60	
Height (cm)	Group A	30	162.1	6.91	150	170	0.200
	Group B	30	159.6	7.76	145	170	
Weight (kg)	Group A	30	55.73	8.598	42	70	0.530
	Group B	30	54.32	8.918	40	70	
Duration of Surgery (min)	Group A	30	97.00	17.30	70	135	0.725
	Group B	30	98.67	19.21	60	130	

The VAS score was significantly lower in the USG SAPB group (Group A) than the Standard control group (Group B) both at rest and coughing ( $p < 0.001$ ) at 8, 12 and 24<sup>th</sup> postoperative hours and 6, 8, 12 and 24<sup>th</sup> hours respectively (**Figure 4a** and **4b**).



**Figure 4a** Postoperative VAS score at rest **Figure 4b** Postoperative VAS score while coughing

The need for rescue analgesia was significantly lower in the USG SAPB ( $p = 0.046$ ) group. However, the analgesia duration was longer in the SAPB group ( $847.5 \pm 55.067$  mins) than the standard control group ( $480.83 \pm 50.26$  min).

The haemodynamic parameters analysis showed no statistically significant difference in mean heart rate over time between the two groups. Similarly, the mean respiratory rate over different time points was also not found to be significantly different between the two groups (**Table 2**).



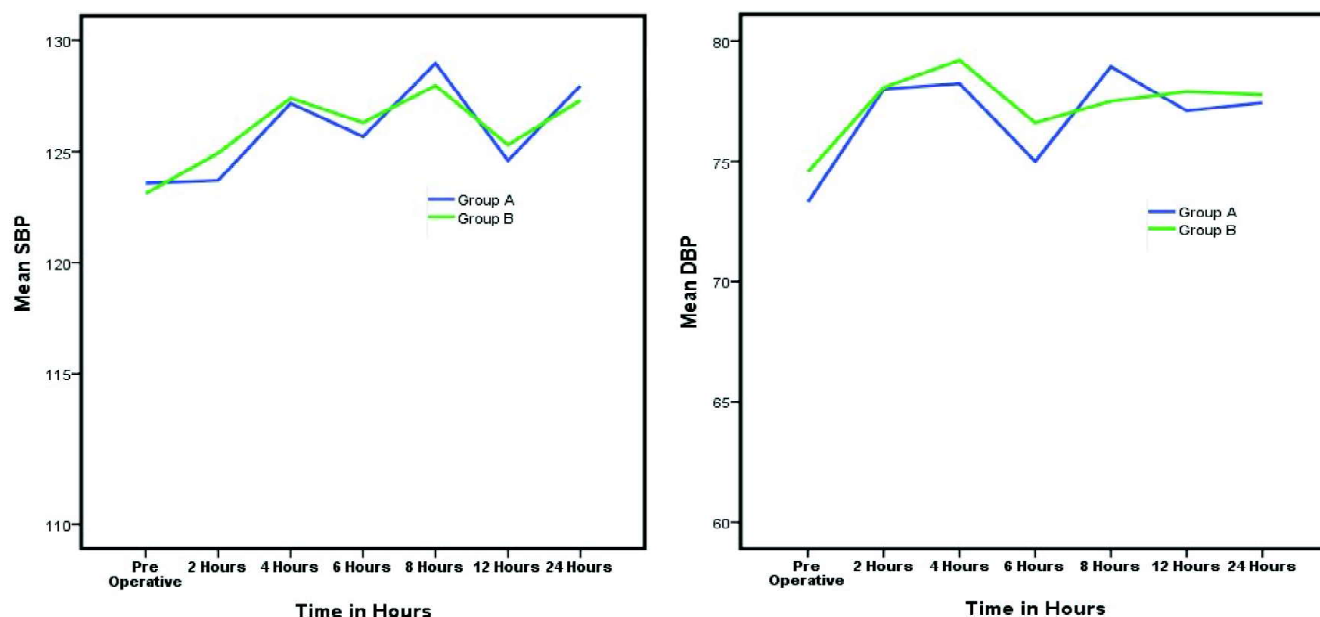
**Table 2** Comparison of heart rate and respiratory rate at a different time of observation between the two groups

Time	Groups	N	Heart Rate			Respiratory Rate		
			Mean	SD	p-value	Mean	SD	p-value
Pre-op	Group A	30	77.8	7.42	0.726	14.4	1.61	0.752
2 Hours	Group B	30	77.13	7.262		14.23	2.388	
	Group A	30	77.7	7.183	0.698	13.13	0.9	0.858
4 Hours	Group B	30	78.47	8.046		13.07	1.818	
	Group A	30	77.9	8.117	0.741	13.6	0.932	0.735
6 Hours	Group B	30	77.27	6.565		13.7	1.317	
	Group A	30	77.73	8.538	0.465	13.73	0.98	0.074
8 Hours	Group B	30	76.17	7.94		13.2	1.27	
	Group A	30	77.2	5.839	0.607	14	1.313	0.057
12 Hours	Group B	30	76.1	10.073		13	1.07	
	Group A	30	77.77	9.328	0.724	14.67	1.626	0.872
24 Hours	Group B	30	77	7.259		14.73	1.552	
	Group A	30	76.87	6.837	0.424	14.33	1.295	0.249
	Group B	30	75.23	8.744		14.73	1.363	

The mean arterial pressure at different time points was compared using the Mann-Whitney U test. No significant differences were observed in mean arterial pressure between the two groups (**Table 3**).

**Table 3** Comparison of mean arterial pressure between two groups

Parameter	Mean		S.D.		p-value (U)
	A	B	A	B	
Pre op	91.34	91.38	5.14	6.04	0.98
0 min	91.79	89.00	6.58	7.09	0.08
15 min	90.58	89.11	4.88	4.57	0.18
30 min	90.00	88.62	4.44	3.80	0.15
45 min	89.69	88.12	4.62	3.48	0.11
60 min	89.68	88.46	6.92	5.17	0.46
75 min	90.00	87.32	6.14	7.08	0.17
90 min	87.88	85.77	2.69	3.65	0.08
105 min	88.44	89.00	2.24	3.74	0.71
120 min	89.50	87.83	3.00	2.04	0.32
135 min	85.00	86.00	-	-	-

**Figure 5a** Variation in SBP in the postoperative period**Figure 5b** Variation in DBP in the postoperative period

Both the procedures' side effects were found to be minimal and similar between both the groups with no significant differences (**Table 4**).

**Table 4** Comparison of adverse effects in both the groups

SIDE EFFECTS	Total	Group A (n=30)	Group B (n=30)	Chi	p-value
Bradycardia	1(1.7%)	0(0%)	1(3.3%)		
Respiratory distress	1(1.7%)	1(3.3%)	0(0%)		
Hypotension	7(11.7%)	4(13.3%)	3(10%)	2.164	0.706
Nausea & vomiting	4(6.7%)	2(6.7%)	2(6.7%)		
None	47(78.3%)	23(76.7%)	24(80%)		

## DISCUSSION

The study's main findings were 1) SAPB reported significantly lower levels of pain after thoracic surgery; 2) the amount of rescue analgesia was lower in the SAPB group; 3) the vomiting incidence was lower in SAPB; 4) SAPB was not associated with any complication.

Various modalities to control PTP have been tried with varied success, for example, 1) intrapleural analgesia, 2) cryo-analgesia, 3) thoracic epidural, 4) paravertebral block, 5) intravenous narcotics, NSAIDs.<sup>11,12</sup>

None could be considered ideal either due to systemic side effects or the lack of technical feasibility. Hence, to search for a near-ideal option of PTP relief in terms of simplicity, safety, efficacy and feasibility, regional techniques came into consideration.

One such regional anaesthesia technique is SAPB which provides paresthesia of T2 to T9 dermatomes of the anterolateral thorax.<sup>13</sup>

In our study, pain score was assessed by VAS at 2<sup>nd</sup>, 4<sup>th</sup>, 6<sup>th</sup>, 8<sup>th</sup>, 12<sup>th</sup> and 24<sup>th</sup>-hour postoperatively, both at rest (VASr) and coughing (VASc). VASr in the patients receiving SAPB (group A) were lower and significant (p-value <0.05) as compared to group B at the 8<sup>th</sup>, 12<sup>th</sup> and 24<sup>th</sup> postoperative hour. Till the 8<sup>th</sup> postoperative hour, there was no difference in the pain scores between the two groups. Analyzing the dynamic VAS scores, pain scores were also lower in the SAPB group (group A), and this difference was significant (p<0.001) at the 6<sup>th</sup>, 8<sup>th</sup>, 12<sup>th</sup> and 24<sup>th</sup> hour. Till the 6<sup>th</sup> postoperative hour, there was no difference in the pain scores between the two groups.

The iv opioids are one of the most commonly used multimodal analgesia technique. However, opioids in large doses have significant side effects like nausea, vomiting, respiratory depression, sedation.<sup>14</sup> The result of our study showed that the total amount of tramadol used was lower in the SAPB group. Most likely, the decrease in the incidence of vomiting in SAPB resulted from lower doses of iv opioids administered.

Thoracic epidural block (TEB) is considered to be the gold standard for PTP. However, this technique requires highly trained medical staff. Risks associated include accidental dural puncture, inadvertent high block, local anaesthetic toxicity and total spinal anaesthesia (unintentional spinal injection of an epidural dose of a local anaesthetic). Additional side effects such as hypotension, neuraxial hematoma, vomiting and urinary retention have also been reported.<sup>15</sup> Furthermore, an epidural puncture is contraindicated in patients who have a local infection, a history of previous spinal surgery, coagulation disorders, on concurrent anticoagulant or antiplatelet therapy.<sup>16</sup>

Paravertebral block (PVB) is a technique that involves the injection of local anaesthetic into the paravertebral space to block nerves after they exit the spinal cord. The major potential complications associated with PVB are total spinal block, pneumothorax and neuronal injury.<sup>16</sup>

Due to these technique's side effects and complications, alternative methods for palliation of thoracotomy pain are the subject of much current research.

In 2011, Blanco<sup>13</sup> described a conceptually new type of regional anaesthesia, the PECs and PECs II (modified pectoralis muscle blocks, for pain control after breast surgery. After that, many studies were carried out. Prominent among these studies were descriptions of SAP block for pain relief of the thorax's anteromedial region.<sup>17</sup>

In the present study, we used ultrasound-guided SAP block in the management of post-thoracic surgery acute pain. This block is easy to perform, has a high success rate, and carries minimal complications. In our study, we performed the block when the patients were already anaesthetized, and hence, they did not experience any discomfort or pain. Furthermore, SAP block usually requires only a single injection compared to most other regional blocks that often need multiple injections. Patients were benefited by experiencing significantly less pain during the early postoperative hours and by requiring lower opioid dosage during that period.

The reason for extensive analgesia of upto mean 847.5 mins, as seen with our study, can due to the spread of the drug along the fascial plane and into the paravertebral space, which is filled with adipose tissue and since local tissue perfusion is low in adipose tissue, it results in low absorption speed of local anaesthetic agent into the blood.<sup>17</sup>

The present study has several limitations: 1) the zone of anaesthesia induced by SAP block sometimes requires the

concomitant use of another anaesthetic technique and 2) the superficial nature of SAP block does not provide a solution for the reduction of pain due to damage to the visceral pleura caused by intercostal drains.<sup>16</sup> SAP block may interfere with the serratus muscle's integrity, and the fascial plane may be disturbed at the surgical incision site and consequently alter the drug distribution.<sup>18,19</sup> It appears that SAP block has a lower risk of local anaesthetic toxicity because the total dose of local anaesthetic injected during ultrasound-guided SAP is smaller than that used in the other techniques, and also, the local anaesthetic agent is injected into an area that is relatively less vascularized.<sup>16</sup>

In the present study, the postoperative VAS scores during the first 8 hours at rest and 6 hours while coughing were similar in both study groups, signifying that the block's analgesic effect persisted for up to 8 hours patients regained consciousness post-surgery. We suggest future studies to investigate the feasibility of prolonging the sufficient postoperative analgesia period induced by SAP block for up to 24 hours.

## CONCLUSION

SAP block is an effective adjuvant treatment option for PTP. Compared to the current methods used for post-thoracic surgery pain relief, SAP block has some significant advantages, mainly its ease of use and its low potential for side effects.

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## REFERENCES

1. Hughes R, Gao F. Pain control for thoracotomy. *Contin Educ Anaesth Crit Care Pain* 2005;5(2):56-60.
2. Bong CL, Samuel M, Ng JM, Ip-Yam C. Effects of preemptive epidural analgesia on post-thoracotomy pain. *J Cardiothorac Vasc Anesth* 2005;19(6):786-93.
3. Craig DB. Postoperative recovery of pulmonary function. *Anesth Analg* 1981;60(1):46-52.
4. Yegin A, Erdogan A, Kayacan N, Karsli B. Early postoperative pain management after thoracic surgery; pre and postoperative versus postoperative epidural analgesia: a randomized study. *Eur J Cardiothorac Surg* 2003;24(3):420-4.
5. Macias A, Monedero P, Adame M, Torre W, Fidalgo I, Hidalgo F. A randomized, double-blinded comparison



- of thoracic epidural ropivacaine, ropivacaine/fentanyl, or bupivacaine/fentanyl for post-thoracotomy analgesia. *Anesth Analg* 2002;95(5):1344-50.
6. Gottschalk A, Cohen SP, Yang S, Ochroch EA. Preventing and treating pain after thoracic surgery. *Anesthesiology* 2006;104(3):594-600.
  7. Ng A, Swanevelder J. Pain relief after thoracotomy: is epidural analgesia the optimal technique? *Br J Anaesth* 2007;98(2):159-62.
  8. Blanco R, Parras T, McDonnell JG, Prats-Galino A. Serratus plane block: a novel ultrasound-guided thoracic wall nerve block. *Anaesthesia* 2013;68(11):1107-13.
  9. Erturk E, Aydogdu Kaya F, Kutanis D, Besir A, Akdogan A, Geze S, et al. The effectiveness of preemptive thoracic epidural analgesia in thoracic surgery. *Biomed Res Int* 2014;2014:673682.
  10. Huskisson EC. Measurement of pain. *Lancet* 1974;304(7889):1127-31.
  11. Wall PD. The prevention of postoperative pain. *Pain* 1988; 33(3):289-90.
  12. Kehlet H, Dahl JB. The value of/† “Multimodal” Or “Balanced analgesia” In postoperative pain treatment. *Anesth Analg* 1993;77(5):1048-56.
  13. Southgate SJ, Herbst MK. Ultrasound-guided serratus anterior blocks. In: *Stat Pearls*. Treasure Island (FL): Stat Pearls Publishing; 2020.
  14. Wang J, Olak J, Ultmann RE, Ferguson MK. Assessment of pulmonary complications after lung resection. *Ann Thorac Surg* 1999;67(5):1444-7.
  15. Takimoto K, Nishijima K, Ono M. Serratus plane block for persistent pain after partial mastectomy and axillary node dissection. *Pain Physician* 2016;19(3):E481-6.
  16. Semyonov M, Fedorina E, Grinshpun J, Dubilet M, Refaely Y, Ruderman L, et al. Ultrasound-guided serratus anterior plane block for analgesia after thoracic surgery. *J Pain Res* 2019;12:953-60.



## RESEARCH PAPER

# Effect of technology-enhanced learning on the development of the procedural skill of 8<sup>th</sup>-semester students in the labour room

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**Background and aims:** Practical skills are an essential part of physicians' daily routine. Nevertheless, medical graduates' performance of basic skills is often below the expected level. Technology has been considered an influential tool in teaching and learning of skills. It assists students in gathering more information to solve the problems and master skills better. Enhanced medical trainee education, using new and emerging technologies for teaching and learning, may increase competency. **Materials and Methods:** In this study, Foley's female catheterisation is selected as a skill for undergraduate students of eight semesters when posted in Jorhat Medical College & Hospital's labour room for one month. 16 M.B.B.S. students of 8th semester who are posted in labour-room per month are the study population. The study was conducted from Nov 1 to Nov 30 2015. It is a comparative study on conventional (Sodoto) model of skills teaching and technology-enhanced (simulation) skills teaching. **Results:** The results indicate an increase in skill competency over time among the same group of students after technology-enhanced and self-directed learning of the skill to perform female catheterisation in the labour room. Feedback also increases the increasing interest of both faculty and students for this new teaching-learning tool. **Conclusion:** Technology-enhanced learning offers a novel pedagogical approach to enhance medical students' medical skill competencies levels. The outcomes of this study have shown an encouraging result.

**Keywords:** Basic practical skills; clinical skills; physical examination; skills training; undergraduate medical education.

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## INTRODUCTION

A current approach in health profession education is the development of competency-based undergraduate curricula.<sup>1</sup>

In Germany, a National Competence-Based Catalogue of Learning Objective for Undergraduate Medical Education (NKLM) came into effect in June 2015.<sup>2</sup> Many of the competences described in the NKLM include the acquisition

of basic practical skills. Regarding basic practical skills (i.e. accomplishing a task like a knot tying or cardiac auscultation), medical stakeholders have raised objections that medical graduates execute such skills below the expected level of performance.<sup>3</sup>

Furthermore, third-year undergraduate medical students reported their competence in core clinical skills like rectal examination or insertion of a nasogastric tube on average with 4.7 on a 6-point (1=excellent) Likert scale.<sup>4</sup> On the other hand, different basic clinical skills training programs seem to offer medical students different preparedness levels regarding physical diagnostic skills,<sup>5</sup> suggesting that some teaching methods for practical skills might result in better performance. An obstacle for teaching practical skills well has been identified in some teacher's lack of confidence in their own physical examination skills.<sup>6</sup>

The traditional apprenticeship model for teaching clinical skills is no longer feasible due to the shortage of faculty<sup>7</sup> however, this educational model may be augmented with simulation training, centralised skills training centres, and Web/Medicine 2.0 applications<sup>8,9</sup> support a constructivist approach to learning.<sup>10</sup> Technology has been considered an influential tool in teaching and learning. It assists students in gathering more information to solve the problems and master skills better. Enhanced medical trainee education, using new and emerging technologies for teaching and learning, may increase competency (performance and communication skill). Once the medical trainee is competent to perform a procedure like female bladder catheterisation, there is very little probability of adverse effects or medical errors. Furthermore, there is an ethical imperative to ensure optimal treatment without harming patients; therefore, technological advancements may provide a safe environment for medical students to practice.<sup>11</sup>

Medical video technology delivered via a PowerPoint/mobile device has great potential for cultivating a favourable learning landscape in medical schools. Educators know that millennial student, born between 1980 and 1994, are technologically adept, stressed, high-achieving, confident, and self-assured.<sup>12</sup> These students demand convenience and require specific educational direction and guidance while attending college. Therefore, the introduction of audiovisual technologies for this type of student is ideal because of convenience and the specific academic content they deliver. These students are accustomed to waking up and automatically having the current medical news, viewpoints, research, and education to listen to and perhaps view while commuting to the university, work, or the gym. This is made possible by podcasts and mobile video technologies. The procedural teaching skill in the use of the labour room with cutting-edge technology. It is the starting point of a better health care service provided by future doctors in turn. These competent doctors will play an essential role in bringing down maternal mortality rates. Teaching procedural skill better can best utilise the first in-hand clinical posting

in the Obstetrics and Gynecology department.

Keeping the aim in mind to study the effectiveness of technology-enhanced learning on developing the procedural skill of 8<sup>th</sup> semester students in the labour room, students should perform Foleys catheterisation in the female after technology-enhanced teaching-learning in the labour room.

## MATERIAL AND METHODS

This was a prospective study. The study sample consisted of 16 final-year medical students of Jorhat Medical College & Hospital. All the students are required to complete this clinical skill during the final year of medical school. The students were assured that participation in the study was voluntary and would not affect any course grades or employment at the concerned Sankardev University of Health Sciences, Assam. They were encouraged and given suggestions to try this method of learning for other clinical skills also. The counselling sessions were held in the labour room, which included the study's purpose, the study's exact procedure, and its implications at the very beginning of the study. Then consents were taken for participation. The students are counselled about the DOPS procedure.

Simultaneously, discussion with faculty of the department of Obstetrics and Gynaecology was held to sensitise them to the concept of this teaching-learning method and assess a student with DOPS.

Traditionally the students learnt Foleys female bladder catheterisation procedure by observing their seniors (S.O.D.O.T.O. Model). This is an essential and most frequently performed procedure in the labour room. Incorrect method of introduction of Foleys female catheterisation may lead to lot many complications. If the students are not taught this procedure in a structured way, this may invite many difficulties. In the traditional method, there was no structured way to teach the technique correctly. This study tried to introduce newer teaching-learning tools like simulator (dummy), video presentation, and YouTube links. With the use of these tools, we have taught the procedure in a structured way.

This study was conducted for one month (Nov 1 to Nov 30 2015) in the labour room J.M.C.H, Jorhat, Assam. DOPS and feedback Questionnaires were peer-reviewed before conducting the study by a few faculty members.

In the Control group (*conventional teaching*) first, 14 days student learnt by traditional way, i.e. they learn by observing their seniors performing the procedure (S.O.D.O.T.O.). On day 14, DOPS was conducted to assess their performance. On day 15, they were asked to attend a class describing the Foley's female catheterisation procedure, which was the side effects of Foley's female catheterisation procedure, assisted by demonstration in dummy and video presentation.

Our institute's video presentation has been recorded where

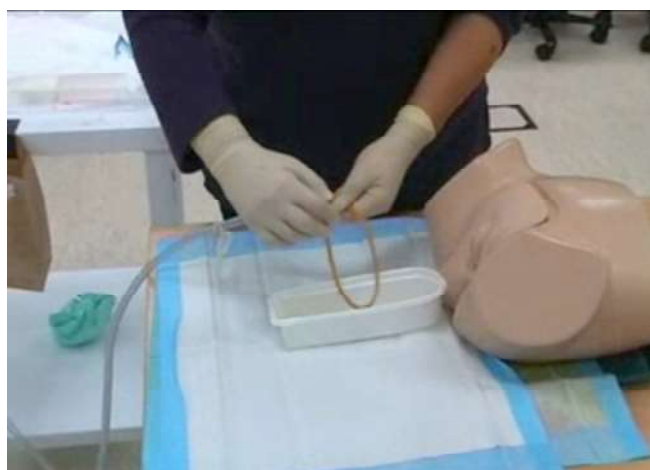


one of our M.B.B.S. interns performed the procedure in our labour room.

To better understand available staff and resources in our institute, the recording is done in our institute. This video has been transferred to the study group via blue tooth for later learning. A demonstration on the dummy followed this. They were suggested about the YouTube links for learning female catheterisation procedures and encouraging self-directed learning in that class. After this intervention, their skills were assessed with DOPS checklist by the involved faculties at the end of the next 14 days. Finally, feedbacks were obtained from both faculties and students. Students were asked whether they liked it or not, and reason for their like or dislike in the feedback form. Faculties were also given feedback in the questionnaire.

### Discussion with faculty and sensitisation

The first session with the faculty members of the department of Obstetrics & Gynecology was a sensitisation session wherein the faculty was introduced to the various tools available for technology-enhanced study and about DOPS assessment which was a new method of evaluation for all



**Figure 1** The type of simulator used in this study

the faculties.

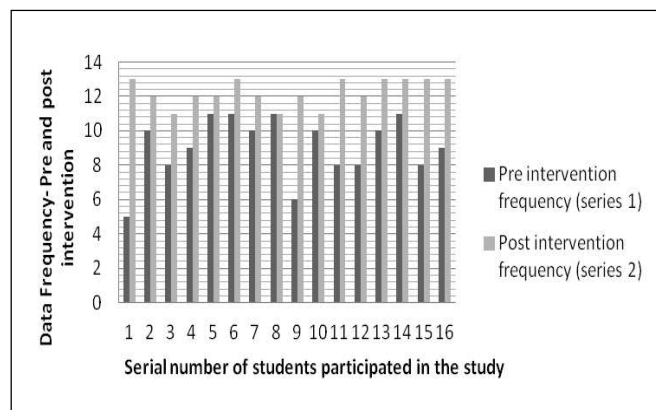
### RESULTS

The results of the study are described below.

**Table 1** Results of pre-test and post-test of the simulation the study

Students Serial no	Pre-test (series 1)	Post-test (series 2)	Mean & S.D. of pre-test	Mean & S.D. of post-test	Paired <i>t</i> - test value
1	5	13		12.25 & 0.774	<0.0001
2	10	12			
3	8	11			
4	9	12			
5	11	12			
6	11	13			
7	10	12	9.0625 & 1.8		
8	11	11			
9	6	12			
10	10	11			
11	8	13			
12	8	12			
13	10	13			
14	11	13			
15	8	13			
16	9	13			

**Table 1** and **Figure 1** reveals 16 students of the eight semesters had undergone a DOPS test (pre-test) after 14 days of the traditional teaching of procedural skill in the labour room. After intervention with technology-enhanced teaching and self-directed learning for the next 14 days, students were reassessed with DOPS by the same faculty group (post-test).



**Figure 1** Comparison of series 1 (pre-intervention/Pre-test) with series 2 (Post-intervention/Post-test)

On analysing data obtained from the questionnaire yield a very positive response. Majority of students have scored well after the intervention was done. The pre-intervention mean score was 9.0625 with SD1.8, which was increased -post-intervention to 12.25 with SD 0.774. The results indicate an increase in skill competency over time among the same group of students after technology-enhanced and self-directed learning of the skill to perform female catheterisation in the labour room. Paired *t*-test results show the two-tailed *P*-value is less than 0.0001. By conventional criteria, this difference is considered to be extremely statistically significant.

While analysing the data obtained from feedback questionnaire, we concluded that 14/16 students had liked the process very much (circled 5) 2/16 students had liked it to a significant extent (circled 4) 8 students commented that they had learnt the procedure very nicely. They will not forget it ever. Two students have commented that the availability of gadgets for learning at the hostel made them spend a lot of time on the Internet. They have switched over to other sites also when tried to see the procedure in YouTube.

While analysing the data obtained from 7 faculties of our department 5 faculties had like the process very much and rest two faculties had liked it to some extent. (Data table and figure to be included)

## DISCUSSION

Students in the health care professions have benefited from repeatedly listening to learning material at their convenience via mobile technology and have reported high satisfaction using audio and video formats in learning.<sup>13,14</sup> Social Web (Web 2.0) applications, such as podcasts/vodcasts, are

becoming, typical technology applications in health care professional education and novel research are being conducted and published regarding learning outcomes.<sup>15,16,17</sup> While no one has clearly defined and agreed on what Medicine or Health 2.0 is, researchers have determined the term originated from the concepts of medicine and Web. 2.0.<sup>18</sup>

A podcast/vodcast may consist of an audio and video file distributed to a selected media player over the Internet, phones, smartphones, iPad-style notebooks, or downloaded to an iPod-like device. Video podcasts may then be referred to as Medicine/Health 2.0 tools to affect health care and education, and perhaps even in underserved countries where mobile health technology is expanding.<sup>19</sup>

Regarding the use of video iPods in higher education, audio and video formats enhance learning outcomes.<sup>19-22</sup> Health care professional students report satisfaction in listening to lecture material and viewing clinical skills.<sup>21</sup> This innovative pocket-sized mobile device is becoming part of the physician's repertoire of diagnostics, educational tools, and research interventions. However, there is a lack of evidence around how mobile technology, and using it as a platform for medical education, affects practitioner competence in clinical skills and procedures.

## CONCLUSION

Technology-enhanced learning offers a novel pedagogical approach to enhance medical 'students' medical skill competencies levels. The outcomes of this study have shown an encouraging result. This study has also illustrated a need for further investigation to generalise to the medical school population. Further research in this area can probably prove that we need this new learning skill the teaching method to make our medical graduate competent to perform procedural skill better than conventional teaching methods. It was used as a starting point of new learning methods and they-learning methods to encourage them to try newer learning methods and learning methods and reported feeling benefitted from this change. The technology-enhanced learning and DOPS assessment may have a definitive role as a motivational tool

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## REFERENCES

1. Tse AM, Iwaishi LK, King CA, Harrigan RC. A collaborative approach to developing a validated competence-based curriculum for health profession students. *Educ Health (Abingdon)* 2006;19(3):331-44.
2. Fischer MR, Bauer D, Mohn K. NKLM-Projektgruppe finally finished! National competence based catalogues of learning objectives for undergraduate medical education (N.K.L.M.) and dental education (N.K.L.Z.) ready for trial. *G.M.S. Z Med Ausbild* 2015;32(3):47-9.
3. Ringsted C, Schroeder TV, Henriksen J, Ramsing B, Lyngdorf P, Jønsson V, Scherpbier A. Medical students' experience in practical skills is far from stakeholders' expectations. *Med Teach* 2001;23(4):412-6. doi: 10.1080/01421590120043017.
4. Fischer T, Chenot JF, Simmenroth NA, Heinemann S, Kochen MM, Himmel W. Learning core clinical skills – a survey at 3 time points during medical education. *Med Teach* 2007;29(3):397-9. doi: 10.1080/01421590701316563.
5. Remmen R, Scherpbier A, Vander VC, Denekens J, Derese A, Hermann I, et al. Effectiveness of basic clinical skills training programmes: a cross-sectional comparison of four medical schools. *Med Educ* 2001;35(2):121-8.
6. Ramani S, Orlander JD, Strunin L, Barber T.W. Whither bedside teaching? a focus-group study of clinical teachers. *Acad Med* 2003;78(4):384–390. doi: 10.1097/00001888-200304000-00014
7. Kohn LT, Corrigan JM, Donaldson MS. *To Err is Human: Building a Safer Health System*. Washington, DC: National Academy Press; 2000.
8. Blum CA, Borglund S, Parcells D. High-fidelity nursing simulation: impact on student self-confidence and clinical competence. *Int J Nurs Educ Scholarsh* 2010;7(1):102-3
9. Boulos MN, Maramba I, Wheeler S. Wikis. Blogs and podcasts: a new generation of web-based tools for virtual collaborative clinical practice and education. *B.M.C. Med Educ* 2006;6:41.
10. Jonassen DH, Peck KL, Wilson BG. *Learning with technology: a constructivist perspective*. Upper Saddle River, NJ: Prentice Hall; 1999;83(986):759-62.
11. Ziv A, Wolpe PR, Small SD, Glick S. Simulation-based medical education: an ethical imperative. *Simul Healthc* 2006 Aug;1(4):252-6.
12. Oblinger DG, Oblinger JL. *Educause. Educating the net generation* 2005;12(2):11.
13. Osterweil N. *Medpage Today*. 2007. Medical students take iPod sounds to heart 2011;13(1):29.
14. Jelesiewicz E. *Temple Time Online Edition*. 2007. iPods help docs improve stethoscope skills.
15. Wiecha J, Heyden R, Sternthal E, Merialdi M. Learning in a virtual world: experience with using second life for medical education. *J Med Internet Res* 2010;12(1):e1.
16. Sandars J, Schroter S. Web 2.0 technologies for undergraduate and postgraduate medical education: an online survey. *Postgrad Med J* 2007 Dec;83(986):759-62.
17. Cain J, Fox BI. Web 2.0 and pharmacy education. *Am J Pharm Educ* 2009 Nov 12;73(7):120.
18. Van De Belt TH, Engelen LJ, Berben SA, Schoonhoven L. Definition of Health 2.0 and Medicine 2.0: a systematic review. *J Med Internet Res* 2010;12(2):e18.
19. Anon. Apple Inc. 2010. iPods in bedside medical education: improving care in developing countries 2013; 16(8):56-8.
20. Tempelhof MW, Garman KS, Langman MK, Adams MB. Leveraging time and learning style, iPod vs. realtime attendance at a series of medicine residents conferences: a randomized controlled trial. *Inform Prim Care* 2009;17(2):87-94.
21. Maag M. iPod ? uPod ? An emerging mobile learning tool in nursing education and students' satisfaction. In: *Proceedings of the 23rd Annual Conference of the Australasian Society for Computers in Learning in Tertiary Education*. 2006 Presented at: *Who's Learning? Whose Technology?* 2006;3(6):78-80.
22. Maag M. Podcasting and MP3 players: emerging education technologies. *Comput Inform Nurse* 2006 Feb;24(1):9-13.





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### RESEARCH PAPER

# A clinical, electrophysiological and radiological study of optic neuropathies in Northeast India: hospital-based study

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**Background and aims:** Optic neuropathy refers to disease of the optic nerve which can present in isolation and/or in association with other neurological or systemic diseases. The present study has been undertaken to study the clinical, electrophysiological and radiological features of various optic neuropathies. **Materials and methods:** This is a prospective observational study and conducted from August 2015 to July 2017 at Gauhati Medical College, Guwahati. Detailed neurological evaluations along with investigation were done in all patients. **Results:** A Total of 112 patients were included among which 57(50.9%) were male and 55(49.1%) were female. Mean age and duration of symptoms was 35.44 years & 2.06±0.97 weeks respectively. Out of 112 patients, bilateral involvement was noted in 57(50.9%) and unilateral in 55(49.1%), so, total 169 abnormal eyes and 55 normal eyes were examined. Associated ocular symptoms were ocular pain, colour vision defect, subjective contrast sensitivity and relative afferent pupillary defect. On fundoscopy; patients were grouped into involvement of optic disc (IOOD/Papillitis), retrobulbar and neuroretinitis on the basis of affected part of optic nerve. Relevant positive findings were aquaporin-4 IgG antibody, Angiotensin converting enzyme, Antinuclear Antibody with reactive VDRL, Toxoplasma serology, anti hepatitis C virus, leptospira serology and low serum vitamin B<sub>12</sub> level. VEP, OCT, CSF and neuro imaging study were done in all patients. Patients were further classified etiologywise among which demyelinating patients' group (MS, NMOSD and AIDON), i.e., 65(58.03%) was major group. Other etiologies included ischemic, Neurosarcoidosis, toxic and others. **Conclusion:** The differential diagnosis of optic neuropathy is extensive and apart from demyelination, other causes like ischemic, nutritional, toxic, infective and autoimmune should be considered. All patients need long term follow up.

**Keywords:** Optic neuropathy; electrophysiological; radiological; etiology.

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## INTRODUCTION

Optic neuropathy occurs in a variety of clinical setting and can present in isolation and/or associated with other neurological or systemic diseases. The key features of optic neuropathy are visual loss (affecting visual acuity, colour vision, or visual field) accompanied by abnormal optic disc appearance or relative afferent pupillary defect (RAPD). The most common causes of optic neuropathy are demyelination, ischemic, toxic and autoimmune disorder. In a tropical country like India, apart from the usual suspects, nutritional and infective should also be considered. Multiple Sclerosis (MS) is moderately prevalent in India (Pandit L et al).<sup>1</sup> Clinical and demographic features are similar to that in the west. Several Indian studies have shown that Optic Neuritis (ON) is the initial manifestation in 23.6 to 53.3% of patients with Multiple Sclerosis (Syal P et al.<sup>2</sup>, Gangopadhyay G et al.).<sup>3</sup>

The present study has been undertaken to study the clinical, electrophysiological and radiological features of various optic neuropathies.

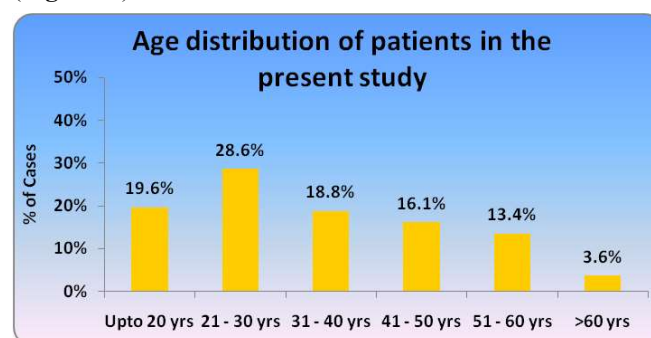
## MATERIAL AND METHODS

In the present study, all patients irrespective of age and sex who presented with history suggestive of optic neuropathy (history of visual loss affecting visual acuity, colour vision, or visual field accompanied by abnormal optic disc appearance or a relative afferent pupillary defect) were included. The exclusion criteria were (i) patients with altered sensorium, (ii) diagnosed cases of optic atrophy, (iii) intracranial space occupying lesions and (iv) patients with history of trauma. It is a prospective observational study undertaken at Gauhati Medical College, Guwahati and conducted from August, 2015 to July, 2017. Detailed neurological evaluation along with complete blood count (CBC) including erythrocyte sedimentation rate (ESR), liver function test (LFT), renal function test (RFT), electrolytes, Venereal Disease Research Laboratory (VDRL), antinuclear antibody (ANA) and chest X-ray (CXR) done in every patient. Leptospira, Toxoplasma, Angiotensin converting enzyme (ACE) were done in selected patients. Other investigations were done as and when needed as per clinical conditions. Cerebrospinal fluid (CSF) study consisted of total cell count

including differential count, sugar, protein, Acid Fast Bacilli (AFB), gram's stain, fungal stain, Adenosine Deaminase (ADA), VDRL, Cryptococcal Antigen, polymerase chain reaction (PCR) for herpes virus, tuberculosis (TB), Japanese encephalitis (JE), ACE, oligoclonal band (OCB). Visual field charting by automated perimetry, optical coherence tomography (OCT), electrophysiological studies include Visual Evoked Potential (VEP) done in all patients. Neuroimaging of brain including orbit and spine was contemplated in all patients. Magnetic Resonance Imaging (MRI) was done in majority of patients although computerized tomography (CT) of brain and orbit was considered in few patients due to financial constraints. Statistical testing was conducted with the statistical package for the social science system version SPSS 17.0.

## RESULTS

Among 112 patients in the study 57(50.9%) were male and 55(49.1%) were female. Mean age was 35.44 years (Standard Deviation (SD) of 15.19 and range 16-81 years (Figure 1).



**Figure 1** Bar diagram showing age distribution of patients affecting most common in 21-30 years of age group

The mean duration of symptoms was  $2.06 \pm 0.97$  weeks (range 0.4-5.4 weeks). Out of 112 patients, bilateral (B/L) involvement was noted in 57(50.9%) and unilateral (U/L) in 55(49.1%) of patients. So, total 169 abnormal eyes and 55 normal eyes were examined. At the time of presentation, first attack was noted in 97(86.60%) of patients, second attack in 14(12.5%) of which 10 patients were of MS and 4 patients



**Figure 2** Bilateral papillitis (A, B) right sided neuroretinitis (C)

were of Neuromyelitis Optica Spectrum Disorder (NMOSD) and third attack noted in 1(0.90%) patient of NMOSD. Ocular pain was noted in 84(75%), colour vision defect in 105(93.8%), subjective contrast sensitivity in 91(81.3%), redness of eyes in 12(10.7%) and RAPD in 61(27.23%) of patients. Out of 224 eyes on fundoscopy, patients grouped into involvement of optic disc (IOOD/Papillitis) in 141(62.9%), neuroretinitis in 6(2.7%) and retrobulbar in 22(9.8%) (**Figure 2**).

Additional significant neurological features noted in the study were headache in 41(36.6%), hemiplegia in 6(5.4%), paraplegia in 4(3.6%), quadriplegia in 8(7.1%), sensory findings in 37(33%), cerebellar involvement in 2(1.8%), bladder and bowel in 12(10.7%) and Lhermitte's sign in 4(3.6%) patients. Out of 112 patients, history of diabetes mellitus and hypertension was elicited in 12(10.7%) patients, patients on antitubercular therapy (ATT) in 8(7.1%), chronic kidney disease (CKD) on haemodialysis in 1(0.9%), chronic liver disease (CLD) in 1(0.9%) and 1(0.9%) patient on

vinblastine for Non Hodgkin's Lymphoma. Baseline investigations revealed raised ESR in 41(36.60%), deranged LFT in 10(8.90%), and deranged RFT in 1(0.89%) patient. Other relevant investigations were positive aquaporin 4 IgG, ACE, ANA including profile, low vitamin B<sub>12</sub>, VDRL, Toxoplasma serology, anti HCV, Screening for Hereditary Leber's (LHON) and Leptospira (**Table 1**).

CSF analysis revealed pleocytosis with low to normal sugar and normal to high protein with raised ADA in 7(6.25%). Other specific positive test in CSF were OCB in 7(6.25%), ACE in 10(8.9%), VDRL in 3(2.60%) of patients. Electrophysiology study (VEP) of 112 patients was recorded among which 169 eyes were abnormal and 55 were normal. Out of 224 eyes, 106(47.32%) eyes showed prolongation of latency and normal amplitude among which demyelinating group. This group include multiple sclerosis (MS), neuromyelitis Optica Spectrum Disorder (NMOSD) and acute idiopathic demyelinating optic neuritis (AIDON) and this group consisted of 85(80%) eyes. 24(10.71%) eyes showed normal latency and decreased amplitude among which ischemic and toxic consisted of 23(95.84%) of eyes. 39(17.41%) eyes showed prolongation of latency and decreased amplitude among which inflammatory, toxic, nutritional and demyelinating consisted of 33(84.61%) of eyes. Visual Field Charting by automated perimetry revealed centrocaecal scotoma in 24(10.71%), central scotoma in 4(1.8%), inferior arcuate scotoma in 4(1.8%), altitudinal in 4(1.8%), triple quadrant scotoma in 4(1.8%), double arcuate scotoma in 2(1%). OCT - Full Macular Thickness (FMT in  $\mu$ ), Total Macular Volume (TMV in  $\text{mm}^3$ ) and Retinal Nerve Fibre Layer (RNFL in  $\mu$ ) of 112 patients among which 169 eyes were abnormal and 55 eyes were normal. Eyes (both normal and abnormal) examined on fundoscopy revealed IOOD/Papillitis in 141(62.9%), neuroretinitis in 6(2.7%) and 77(34.4%) were normal of which 22(9.8%) were retrobulbar and 55(24.6%) were normal eyes. Findings were statistically analysed and p value ( $<0.001$ ) is significant for all the grouped analysed. MRI brain including orbit (plain and contrast) was

**Table 1** Relevant abnormal investigation parameters

Investigations	Frequency	Percentage
Aquaporin-4 IgG antibody	14	12.5%
ANA including others	3	2.6%
Low serum vitamin B12	3	2.6%
Anti hcv including others parameters	1	0.89%
Leptospira serology	1	0.89%
Toxoplasma serology	2	1.78%
Serum VDRL	3	2.6%
Serum ACE	10	8.9%
Screening for LHON	1	0.89%
Meningeal biopsy (non-significant)	2	1.78%



**Figure 3** (A, B, C) MRI showing T2 and FLAIR hyper intensities denoting demyelinating lesions in Brain and spinal cord



done in 76(67.85%) patients which revealed optic nerve abnormalities (enhancement/enlargement) in 57(75%) patients, periventricular lesions in 15(19.73%) patients of multiple sclerosis, white matter ischemic changes in 14(18.42%) patients. Out of 30 patients in which MRI Spine was done longitudinal extensive transverse myelitis (LETM) noted in 10(33.33%) and acute partial transverse myelitis (APTM) in 1(3.33%). CT scan of brain with orbit (plain and contrast) done in 36(32.14%) patients which revealed optic nerve abnormalities in 3(8.33%) patients and others were nonsignificant (**Figure 3**).

## DISCUSSION

The optic nerve, the extension of the central nervous system, is really a tract and not a peripheral nerve. It begins anatomically at the optic disc, but physiologically and functionally within the ganglion cell layer of retina. The optic nerve is about 50mm long and extends from the eye to the optic chiasm. It has four portions: Intraocular or the optic disc (1mm), Intraorbital (25mm), Intracranial (9mm) and intracranial portion (16mm). Arterial supply is from the ophthalmic artery and the veins draining the optic head and the remaining orbit have no valves and freely anastomose which ultimately drain into the central vein of the retina. Once

the diagnosis of optic neuropathy has been made, wide differential diagnosis of possible etiologies like demyelinating, inflammatory, ischemic, toxic others should be considered. If the optic nerve head is swollen on ophthalmoscopy, then the term papillitis or anterior ON is used and if it is normal on ophthalmoscopy, then it is called retrobulbar ON (Cogan DG et al).<sup>4</sup>

Based on the site of involvement, ON can be categorized into four main subtypes (Osborne BJ et al)<sup>5</sup>

1. Papillitis: involvement of the optic disc.
2. Perineuritis: involves the optic nerve sheath while the optic disc may/may not be swollen.
3. Neuroretinitis: Concomitant swelling of the optic nerve and the macula. Exudates that form around the macula give the appearance of a star.
4. Retrobulbar neuritis: involvement of optic nerve behind the eye.

In the present study of 112 patients, 57 (50.9%) were male & 55 (49.1%) were female, mean age of the patients was 35.44 years (SD – 15.19 & range 16-81 years) & mean duration of symptoms was  $2.06 \pm 0.97$  weeks (range 0.4-5.4 weeks). Comparison with various studies is summarized (**Table 2**)

**Table 2** Various studies conducted with their age and sex distribution

Author	Gangopadhyay et al. <sup>3</sup>	Jain et al. <sup>6</sup>	Syal et al., <sup>2</sup> Jena SS <sup>7</sup>	Bansil et al. <sup>8</sup>	Present study
Years covered by study	1989-1999	1957-1980	1986-1998	1990	2014-2017
Population	Indian	Indian	Indian	Indian	Indian
No of patients	45	354	100	81	112
Mean age	30.5	27	28.5	27.5	$34.6 \pm 11.855$
Female: male	1.50:1	1.32:1	1.32:1	2.25:1	1.5:1

Further 112 patients were classified according to etiology, of which NMOSD consisted of 18(16.07%) patients; MS consisted of 15(13.39%) patients, AIDON consisted of 32(28.57%) patients. Hence if these three groups (MS, NMOSD and AIDON) were taken together, then the total number of patients will be 65(58.03%) patients were of demyelinating etiology. AIDON is by far the most common type of optic neuritis throughout the world. Although the clinical syndrome of acute optic neuritis has been well recognized for many years, much information about ON was obtained from the optic neuritis treatment trial (ONTT; Roy W Beck et al).<sup>9</sup> Other etiology were ischemic consisted of 12(10.71%) patients, probable Neurosarcoidosis consisted of 10(8.9%) patients, toxic consisted of 9(8.03%) patients, Luetic consisted of 3(2.67%) patients, nutritional consisted of 3(2.67%) patients, autoimmune consisted of 3(2.67%) patients, Toxoplasma consisted of 2(1.78%) patients,

neuroretinitis of possible viral etiology consisted of 2(1.78%), hepatitis C consisted of 1(0.89%) patient, Leptospira consisted of 1(0.89%) patient, hereditary Leber's consisted of 1(0.89%) patient (**Table 3**).

In the present study B/L involvement was seen in 57(50.9%) and U/L in 55(49.1%). Further, progression (PR), associated ocular pain, colour vision defect and subjective contrast sensitivity were noted in which 94(83.92%) patients' symptoms were non progressive (NP). Bilateral involvement was more common in patients of demyelinating etiology. Among 32 patients of AIDON, 2 patients developed features of MS on follow up. In other etiologies like Ischemic, Neurosarcoidosis and toxic, patients also had predominantly bilateral involvement. Adie et al.,<sup>10</sup> found only one case of B/L ON in series of 70 patients. In retrospective analysis by Morrissey et al.,<sup>11</sup> in 23 adults found that causes of B/L



**Table 3** Etiology wise patients' distribution

Etiology	Bilateral	Unilateral	Total	Avg. age (years)	Sex(m/f)
NMOSD	10	8	18	32.33 ±15.537	6/12
MS	5	10	15	34.6 ±11.855	6/9
AIDON	14	18	32	28.59 ±11.12	17/15
Ischemic	7	5	12	52.67 ± 14.49	4/8
Neurosarcoidosis	6	4	10	40.7 ±12.597	5/5
Toxic	8	1	9	34.67 ±11.53	7/2
Luetic	1	2	3	45 ± 21.79	3/0
Nutritional	1	2	3	39 ± 20.66	3/0
Autoimmune	3	0	3	41.67 ±7.638	1/2
Toxoplasma	0	2	2	23 ±7.07	1/1
Neuroretinitis	0	2	2	21.5 ± 2.12	2/0
Hepatitis C	1	0	1	33	1/0
Leptospira	0	1	1	81	0/1
Hereditary Leber's	1	0	1	22	1/0
Total	57	55	112		59/53

simultaneous acute ON seen in 5(22%) who developed clinical evidence of MS. In many of these series, the time interval between attacks in the two eyes is not stated. Park K et al.,<sup>12</sup> observed Uhthoff's phenomenon in 48.1% of their patients. Jena SS et al.,<sup>7</sup> in their study found Uhthoff's phenomenon in 5 patients (3.2%) out of 157 patients whereas in the present study Uhthoff's phenomenon is noted in 4(3.6%) patients. Ischemic optic neuropathies (IONs; Hayreh SS et al.)<sup>13</sup> constitute a major cause of blindness or seriously impaired vision among the middle aged and elderly population. IONs consist primarily of two types: anterior ischemic optic neuropathy (AION) and posterior ischemic optic neuropathy

(PION). The term 'autoimmune optic neuritis' has been suggested for cases of optic neuritis in which there is both serologic evidence of vasculitis, such as positive ANA, but no signs of systemic involvement other than the optic neuropathy; and progressive visual loss that tends to be responsive to treatment with systemic corticosteroids and that is often steroid dependent. Moreover, in the present study including probable Neurosarcoidosis patients didn't suggest pulmonary involvement both clinically and radiologically. In the present study, Neurosarcoidosis was categorized as per zajicek diagnostic criteria (Ferriby D et al.)<sup>14</sup> (**Table 4**).

**Table 4** Zajicek diagnostic criteria

<b>Definite</b>	
1.	Histologic confirmation of affected tissue
<b>Probable</b>	
1.	Evidence of CNS inflammation on MRI or CSF
2.	Evidence of systemic sarcoidosis with histologic confirmation and/or at least two of the following indirect indicators: FDG-PET, gallium scan, chest imaging, serum ACE
<b>Possible</b>	
1.	Above criteria not met

The optic neuropathy in tubercular meningitis (TBM) in 8(7.1%) patients was due to ATT in the studied patient as it occurred after 7-10 days of starting ATT and was not due to other causes of visual loss in TBM as supported by repeat investigation including neuroimaging which didn't showed any new feature. Ethambutol is undoubtedly most often implicated in toxic optic neuropathy. The potential for visual impairment was recognized soon after it was introduced.

Optic neuritis due to Isoniazid has been described sporadically among adult patients. The onset of visual symptoms generally occurs within ten days of starting antitubercular therapy but may occur even two to three months after initiation of therapy.

Analysis of initial perimetry in the ONTT (Roy W. Beck et al)<sup>9</sup> showed that the most common presenting pattern was a diffuse field defect (48%), with altitudinal/arcuate defects in 20%, and central/cecocentral loss in only 8% and it has long

been postulated that ON tends to affect the papillomacular bundle with resultant central/cecocentral scotoma in ON patients. While studying CSF of ON patients, Puccioni SM et al.<sup>15</sup> concluded CSF OCB in 85% of patients with definite MS. Further studies have showed that patients with positive OCB have a worse prognosis in comparison to those with negative bands, and the risk of progression to a second attack is doubled. In the analysis of VEP, Kiiski HS et al.,<sup>16</sup> showed P100 latencies to be prolonged in MS compared to healthy controls. In the study by Halliday et al.,<sup>17</sup> and Matthews et al.,<sup>18</sup> VEP was prolonged and abnormal in almost all patients of ON and stated VEP was more sensitive than MRI in respect to ON. As per ONTT (Roy W Beck et al),<sup>10</sup> the VEP is often abnormal in patients with ON and an abnormal VEP in a clinically diagnosed ON does not alter the diagnostic or treatment. In terms of OCT, Z Habet-Wilner et al.,<sup>19</sup> demonstrated flattening of the foveal contour, thickening of

the neurosensory retina, and accumulation of subretinal fluid in all studied eyes. A vast change was seen in the line of optic neuropathies with the widespread availability of MRI leading to CT scan role to a little. As per ONTT (Roy W Beck et al.),<sup>9</sup> periventricular white matter signal abnormalities on MRI consistent with MS had been reported in 40 to 70% of cases of isolated ON. MRI with gadolinium may show enhancing lesions in 26 to 37% of patients with isolated ON and may increase the detection of disease activity. MRI generally cannot distinguish acute demyelinating optic neuritis from other forms of inflammatory optic neuropathy. e.g., sarcoidosis, syphilis (Cornblath WT et al.).<sup>20</sup> Patients having prior nonspecific neurologic symptoms with previous history of optic neuritis with abnormal MRI scan having three or more lesions and increased CSF oligoclonal bands have high risk for developing MS. Comparison of MRI findings between NMOSD and MS are summarized (**Table 5**).

**Table 5** Comparison of MRI findings between NMOSD and MS

	NMOSD	MS
Spinal cord	Longitudinally extensive lesion ( $\geq 3$ vertebral segments)	Short, often multiple lesions
	Central/gray matter involvement	Peripheral/asymmetrical/often posterior
	T1 hypointensity common on acute lesions	T1 hypointensity rare
Optic nerve	Long-length/posterior-chiasmal lesions	Short-length lesions
Brain	Periependymal lesions surrounding the ventricular system (wide-based along the ependymal lining)	Dawson fingers (perpendicular to ventricles)/s-shaped u-fiber lesions, inferior lateral ventricle and temporal lobe lesions
	Hemispheric tumefactive lesions	Cortical lesions
	Lesions involving corticospinal tracts	Perivenous lesions
	“cloud-like” enhancing lesions	Ovoid or ring/open-ring enhancing lesions
Others	Normal-appearing tissue involvement may be limited to lesional tracts and associated cortex	Normal-appearing white matter manifests tissue damage using special mri techniques
	Lesional myo-inositol reduced on magnetic resonance spectroscopy;	Lesional n-acetyl-aspartate reduced on magnetic resonance spectroscopy;

## CONCLUSION

Our study showed that optic neuropathy can have varied etiology. Though demyelinating disease was the major group but other causes of optic neuropathies like ischemic, nutritional, toxic, infective and autoimmune should be considered. A proper diagnosis can only lead to optimal management and follow up.

**Ethical clearance:** Taken.

**Conflict of interest:** Nil.

**Source of funding:** None declared.

## REFERENCES

1. Pandit L, Kundapur R. Prevalence and patterns of demyelinating central nervous system disorders in urban Mangalore, South India. *Mult Scler* 2014 Oct;20(12):1651-3.
2. Syal P, Prabhakar S, Thussu A, Sehgal S, Khandelwal N. Clinical profile of multiple sclerosis in north-west India. *Neurol India* 1999 Jan 1;47(1):12.
3. Gangopadhyay G, Das SK, Sarda P, Saha SP, Gangopadhyay P, Roy TN. Clinical profile of multiple sclerosis in Bengal. *Neurol India* 1999 Jan 1;47(1):18.
4. Cogan DG. Optic Nerve: Lesions. *Neurology of the*

- Visual System. Springfield: Charles C. Thomas; 1980:150-180.
5. Osborne BJ, Volpe NJ. Optic neuritis and risk of MS: differential diagnosis and management. *Cleve Clin J Med* 2009 Mar 1;76(3):181-90.
  6. Jain S, Maheshwari MC. Multiple sclerosis: Indian experience in the last thirty years. *Neuroepidemiology* 1985 Nov 5;4(2):96-107.
  7. Jena SS, Alexander M, Aaron S, Mathew V, Thomas MM, Patil AK et al. Natural history of multiple sclerosis from the Indian perspective: experience from a tertiary care hospital. *Neurol India* 2015 Nov 1;63(6):866.
  8. Bansil S, Singhal BS, Ahuja GK, Ladiwala U, Behari M, Friede R. Comparison between multiple sclerosis in India and the United States- a case-control study. *Neurology- American academy of neurology* 1996 Feb 1;46(2):385-7.
  9. Roy W. Beck. Optic neuritis study group. The clinical profile of optic neuritis: experience of the optic neuritis treatment trial. *Arch Ophthalmol* 1991 Dec 1;109(12):1673.
  10. Adie WJ. Observations on the etiology and symptomatology of disseminated sclerosis. *Br J Ophthalmol* 1932 Dec 3;2(3752):997.
  11. Morrissey SP, Borruat FX, Miller DH, Moseley IF, Sweeney MG, Govan GG, et al. Bilateral simultaneous optic neuropathy in adults: clinical, imaging, serological, and genetic studies. *J Neurol Neurosurg Psychiatry Res* 1995 Jan 1;58(1):70-4.
  12. Park K, Tanaka K, Tanaka M. Uhthoff's phenomenon in multiple sclerosis and neuromyelitis optica. *Eur J Neurol* 2014 Aug 28;72(3-4):153-6
  13. Hayreh SS. Acute ischemic disorders of the optic nerve: pathogenesis, clinical manifestations and management. *Ophthalmol Clin North Am* 1996;9:407-42.
  14. Ferriby D, De Seze J, Stojkovic T, Hachulla E, Wallaert B, Blond S, et al. Manifestations cliniques et approche thérapeutique de la neurosarcoïdose: 40 cas. *Rev Neurol (Paris)* 2000;156(11):965-75.
  15. Polman CH, Reingold SC, Banwell B, et al. Diagnostic criteria for multiple sclerosis: 2010 revisions to the McDonald criteria. *Ann Neurol* 2011;69:292-302.
  16. Lukes SA, Crooks LE, Aminoff MJ, Kaufman L, Panitch HS, Mills C. Nuclear magnetic resonance imaging in multiple sclerosis. *Ann Neurol* 1983 Jun 1;13(6):592-601.
  17. Halliday AM, McDonald WI, Mushin J. Delayed visual evoked response in optic neuritis. *The Lancet* 1972 May 6;1(7758):982-5.
  18. Matthews WB, Small DG, Small MA, Pountney E. Pattern reversal evoked visual potential in the diagnosis of multiple sclerosis. *J Neurol Neurosurg Psychiatry Res* 1977 Oct 1;40(10):1009-14.
  19. Habot-Wilner Z, Zur D, Goldstein M, Neudorfer M. Macular findings on optical coherence tomography in cat-scratch disease neuroretinitis. *Eye (Lond)* 2011 Aug; 25(8):1064-68.
  20. Cornblath WT, Quint DJ. MRI of optic nerve enlargement in optic neuritis *Neurology- American academy of neurology* 1997 Apr 1;48(4):821-5.



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### RESEARCH PAPER

# A case series on suicide by hanging: a prospective study conducted in Mumbai region

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**Background and aims:** The present scenario of globalisation, urbanisation and industrialization is creating lot of stress on individual in particular as well as on the society in common. Person who are not able to sustain these stressful situations are the major victims of suicidal deaths. **Materials and methods:** Present study is carried out at the department of Forensic Medicine and Toxicology and post mortem centre of a tertiary care hospital and a medical college in Mumbai region. Suicidal hanging cases over the last two years were included for this study. The statistical analysis was carried out using the Microsoft Excell and SPSS software 18. Ethical clearance was obtained from the ethics committee of the institute. **Results:** A total 124 cases of hanging were studied in detail. Out of 124 suicide cases 77 were males (62.10%) and 47 were females that is 37.90%. Fifty-seven victims were of age group between 21 to 30 years (45.97%). Privacy for suicide was maintained by selecting lonely place by 97 cases (78.22%). **Conclusion:** The most commonly affected age group was between 21 to 30 years. In the present study male victims (62.10%) outnumbered the female victims. The lower socioeconomic group was more vulnerable (49.5%) for suicide. Most victims were married and committed suicide due to unemployment and money crisis. The commonest cause of suicide in housewives was marital disharmony and dowry related issues.

**Keywords:** Suicidal hanging; vulnerable age group; socioeconomic status; privacy for suicide; suicide note.

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## INTRODUCTION

Suicide is a major public health problem: approximately 0.9% of all deaths are the result of suicide. About 1000 persons are estimated to commit suicide each day worldwide.<sup>1</sup> Suicide may be defined as, “an intentional act causing harm to a person amounting to death and committed by person himself in the absence of contribution from any external agency particularly in the commencement of act.”<sup>2</sup> Recently the term suicide has been replaced by “Intentional Self-Harm” (ISH) in the scientific literature due to derogatory nature of the word “Suicide”.<sup>2</sup> Hanging is almost always suicidal or accidental, the former being by far the most common.<sup>3</sup> Most hangings are self-suspensions, this may be carried out by a wide variety of methods, but a typical method of self-suspension is to attach a thin rope to a high point such as a ceiling beam or staircase.<sup>3</sup> Any substance that is available at the time of the impulse has been used by the suicides as a ligature for hanging.<sup>4</sup>

## MATERIALS AND METHODS

This study is prospective study carried out at post mortem centre attached to Medical College in Mumbai. Only the alleged suicidal cases or suspected suicidal deaths by hanging are included in this study. The natural deaths, accidental deaths, deaths due to multiple injuries are excluded. The study duration is two years, i.e., from 1<sup>st</sup> October 2012 to 30<sup>th</sup> September 2014.

**Collection of data:** The primary data in each case is collected from the police inquest along with the statement of relatives taken by investigating officers. Findings of thorough external examination and internal examination of the corpse studied in detail. Post mortem reports were studied in all cases and suicide notes were investigated. Further toxicological analysis and crime scene visit was done wherever feasible.

**Data Analysis:** Data were imported from Microsoft Excel into SPSS. The later same software was used to generate figures and to calculate descriptive statistics, including: means, ranges, odds ratios, confidence intervals, and p values. Chi Square test was employed to evaluate the statistical significance of differences between the categorical variable.

## RESULTS

Total of 3429 cases were referred for medico-legal post mortem examination. Out of these 1669 cases are natural and 1314(38.3%) cases are unnatural. In 1314 unnatural cases 216 are of suicide (16.43%). Out of total 216 cases of suicide 124 cases (57.4%) are of hanging. Every case of hanging is studied in detail and the following observations are made.

**Age:** The cases are divided in seven age groups as follows, (0-10) years no case found, (11-20) 9 cases(7.25%), (21-30) 57 cases(45.97%), etc. The minimum age observed

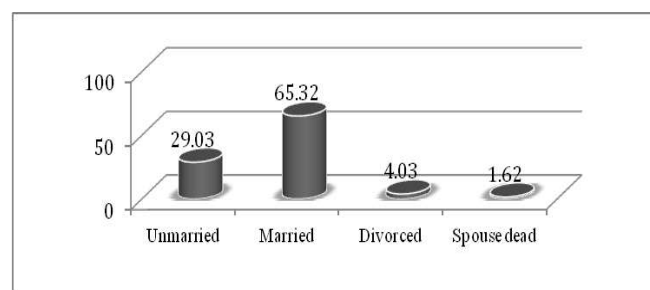
among victims is 11 years and maximum age is 85 years (**Table 1**).

**Table 1** Age group wise distribution

Age group (years)	Frequency	Percent
11-20	9	7.25
21-30	57	45.97
31-40	30	24.20
41-50	12	09.68
51-60	7	5.65
> 60	9	7.25
Total	124	100

**Gender:** Out of 124 suicide cases 77 are males (62.10%) and 47 are females (37.90%). Male to female ratio is 1.6:1. Mean age for male and female is 37(36.79) year and 29(29.12) year respectively.

**Marital Status:** Out of 124 cases 81 cases are married (65.32%) and 36 cases(29.03%) are unmarried, etc. (**Figure 1**).



**Figure 1** Marital status

**Table 2** Mean age

Gender	Marital status	Number	Mean age
Female	Unmarried	13	20 (20.15) years
	Married	32	33 (32.71) years
Male	Unmarried	23	25 (25.43) years
	Married	49	40 (39.79) years

**Occupation:** Out of 124, 22 victims were labourers (17.74%), housewives- 29 cases (23.4%), students- 2 in

number (1.61%), prisoners- 1 case (0.8%), farmers- 3 cases (2.41%) Those having no job at present are 27 in number (21.78%).

#### Statistical analysis:

- Null hypothesis: There is no association between the gender and employment in suicide.
- Alternate hypothesis: There is an association between the gender and employment in suicide.

Out of 124 suicidal cases employment was not known in 11 cases so chi square table is prepared for 113 cases and the result is interpreted.

**Table 3** Chi-square test

		Employment		Total
		Yes	No	
Gender	Female	7	39	46
	Male	24	43	67
Total		31	82	113

Chi square ( $X^2$ ) value of the above table is 5.81.

Degrees of freedom (d.f.)

= (Column - 1) (Row - 1) = (2 - 1) (2 - 1) = 1

Chi square ( $X^2$ ) tabulated value of d.f. = 1

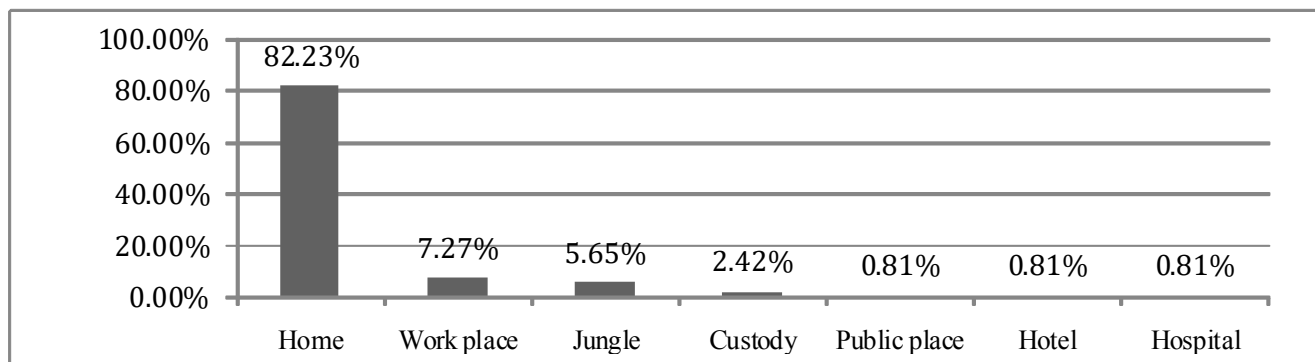
is 3.84 at  $p < 0.05$  i.e. at 95 % level of significance.

As the calculated chi square ( $X^2$ ) value is higher than the tabulated ( $X^2$ ) value, we should reject the null hypothesis and accept the alternate hypothesis. Probability of the difference occurring in gender and employment by chance is less than 5 out of 100 cases, i.e., probability of not getting the difference between gender and employment in nature is 95%. So the gender and employment are associated in suicide.

**Socioeconomic status:** Depending on Kuppaswamy's socioeconomic scale groups are made, upper class - 9 cases (7.25%), middle-upper class- 3 cases (2.42%), middle-lower class- 50 cases (40.33%), and lower class 62 cases (50.0%). Out of 124 cases 100 cases are Hindu (80.64%), 18 cases are Muslim (14.52%) and 6 cases are Christian (4.84%). Time of suicide preferred by 32 victims is morning -25.80%, afternoon - 44 cases (35.49%), evening- 16 cases (12.90%), night - 21 cases (16.93%) and late night in 11 cases (8.88%).

**Privacy for suicide:** Privacy for suicide is maintained by selecting lonely place by 97 cases (78.22%) but not so by 27 cases (21.78%). In 98 cases (79.03%) suicide is committed following sudden provocation and in 25 cases (20.17%) suicidal act is planned and pre decided. In 4 cases (3.23%) there is a definite history of previous attempts of suicide. In four cases (3.23%) multiple methods are used for committing the suicide.

**Place of suicide:** Place of suicide is own residence in 102 cases (82.23%), Work Place- 9 cases (7.27%) (**Figure 2**).



**Figure 2** Place of suicide

**Behavioural changes:** Behavioural changes were noticed by relatives in 107 cases (86.3%), changes like become silent and less talkative, short tempered and violent or rowdy etc. Diagnosed psychiatric illness was found in 8 cases (6.45%). History of acute depression is present in 29(23.38%) individuals. In 22 cases (17.74%) chronic illness was documented as a reason for suicide. Alcohol addiction present in 18 cases (14.52%). Menstrual history was present in 5 cases (10.64%) out of 47 females.

**Suicide within seven years after marriage:** This parameter was studied because Section 304B of Indian Penal Code deals with dowry death: 1) Where the death of a woman is caused by any burns or bodily injury or occurs otherwise than under normal circumstances within Seven years of her marriage and it is shown that soon before her death she was subjected to cruelty or harassment by her husband or any relative of her husband for, or in connection with, any demand for dowry, such death shall be called "dowry death", and such husband

or relative shall be deemed to have caused her death.<sup>5</sup>

In present study out of 47 females, 32 females (68.08%) were married and out of which 15 females (46.87%) were within the seven years of marriage. Out of 15 cases in 3 cases (20.0%) maternal relatives had allegation about death.

**Ligature material used:** Commonest ligature materials used for hanging are rope in 46 cases (37.1%) followed by dupatta in 41 cases (33.1%) etc. (Table 4).

**Table 4** Ligature material used

Material	Frequency	Per cent
Rope	46	37.1
Dupatta	41	33.1
Sari (Saree)	15	12.1
Shawl	7	5.6
Bedsheet	5	4.0
Cable wire	2	1.6
Shirt	2	1.6
Lungi	2	1.6
Rubber tube	1	0.8
Jeans belt	1	0.8
Packaging tape	1	0.8
Not known	1	0.8
Total	124	100

Commonest suspension points used is ceiling fan 66 cases (53.2%) followed by ceiling (roof) 35 cases (28.2%), Fixed knot was present in 105 cases (84.7%), running noose in 18 cases (14.5%).

**Suicide note:** Suicide notes found in 10 cases (8.07%) and not found in 114 cases (91.93%). All suicide notes language was in mother tongue. In one case (10.0%) written on left forearm. Electronic device (laptop) is used in one case (10.0%). In all suicide notes reason for suicide was mentioned.

## DISCUSSION

In present study ligature mark is present in all 124 cases (100%). Suicide predominantly noted in males, i.e., 62.1% compared to females, i.e., 37.9% consistent with PN suresh kumar<sup>6</sup> (51.9%) and correlates with study of Sachil Kumar et al<sup>7</sup> (56.61%), Bennett and Collins et al.<sup>8</sup> (79.5%) and Kanchan T et al.<sup>9</sup> (73.7%). As per Table 1 most vulnerable age group is between 21 to 30 years (45.97%) consistent with Behera A et al<sup>10</sup> and Ambade VN et al.<sup>11</sup> In this younger age group suicidal tendency is more frequently observed may be due to frustration and acute depression secondary to exam failure, unsuccessful love affair, marital disharmony and unemployment, etc.

According to **figure 1** suicide incidences are more in married (65.32%) correlated with Behera A et al.<sup>10</sup> (72.32%) and Kadu Sandeep et al.<sup>13</sup> (74.68%), but Panarat Sritus et al.<sup>12</sup> observed more in unmarried (46.7%). Maximum victims are Hindu (80.64%) consistent with Kadu Sandeep et al.<sup>13</sup> (87.0%) and Kanchan T et al.<sup>9</sup> The incidence of suicide is noted more in housewives (23.4%) followed by those have no job (21.78%) consistent with PN Suresh Kumar et al.<sup>6</sup> may be due to stress and marital disharmony. Maximum (50.0%) cases are from lower socioeconomic class consistent with Kadu Sandeep et al.<sup>13</sup>

As per **Figure 2** place of suicide is own residence in 82.23% individuals consistent with Rodge et al.<sup>14</sup> (65%) and Lisa BE Shields et al.<sup>15</sup> (63.9%). Maximum cases occurred in afternoon, (35.49%) but Panarat Sritus et al.<sup>12</sup> and Kadu Sandeep et al.<sup>13</sup> found in morning (40.30%) and Behera A et al.<sup>10</sup> in night. In afternoon family members are outside from home for job so that female victims get privacy for their suicide act. In present study suicide note is observed in 8.07% cases correlated with Bennett and Collins et al.<sup>8</sup> (22%) and Panarat Sritus et al.<sup>12</sup> (3.70%). Privacy for suicide is maintained by selecting lonely place by 78.22% victims but not so by 21.78%.

In 3.23% cases definite history of previous attempts of suicide noted consistent with Bagadiya et al.<sup>16</sup> (7%). Documented chronic illness is a reason for suicide in 17.74% cases consistent with Behera A et al.<sup>10</sup> (16.4%) and Kadu Sandeep et al.,<sup>13</sup> (9.49%). Diagnosed psychiatric illness is found in 6.45% cases consistent with Sachil Kumar et al.<sup>7</sup> (10.9%). In 3.23% cases victims preferred more than one method to commit suicidemay be because of failure of first consistent with Behera A et al.<sup>10</sup> (2.51%). Menstrual history is present in 10.64% females consistent with Behera A et al.<sup>10</sup> (30%). 46.87% females committed suicide within the seven years of marriage consistent with DS Bhullar et al.<sup>17</sup> (44.19%).

According to **Table 4** rope (37.1%) is the commonly used ligature material by males followed by dupatta (33.1%) by females, consistent with Ambade VN et al.<sup>18</sup> Unusual ligature materials like cable (TV) wire and packaging tape is used by victims who committed suicide at workplace and where these materials are used by them for their work. Most commonly used suspension point used for hanging is ceiling fan in 53.2% cases closely related with studies of Patel AP<sup>19</sup> and Meera Th et al.<sup>20</sup> In present study unusual suspension points like door grill, window grill, railing, ladder and swinging chair hook at roof are used by victims and their body found in partial hanging position. The type of knot is fixed noose in 84.7% cases and running noose in 14.5% cases consistent with Ambade VN et al.<sup>15</sup> Complete hanging seen in 79.83% victims followed by partial hanging (20.17%) consistent with Ambade VN et al.<sup>15</sup> Dried saliva stains are found over the angle of mouth in 28.22% cases and absent in remaining 71.78% cases of suicidal hanging dribbling of saliva/salivary

stains not observed, which indicates absence of saliva need not necessarily indicate that the hanging is not ante mortem and not suicidal.

## CONCLUSION

Suicide tendency is more in males as compared to females. Younger age group (21 to 30 years) is more vulnerable for suicide. Commonest cause of suicide in housewives is marital disharmony and dowry related issues. Unemployment and money crisis is the commonest cause of suicide. Own residence preferred by maximum (82.23%) victims. Behavioural changes are noticed by relatives in 86.3 percent cases. Preferred language for suicide note is mother tongue of victims. Privacy for suicidal act is maintained by 78.22% victims. Mentally ill persons are highly prone to develop suicidal tendency. In menstrual phase suicidal tendency is more seen in females. Dowry demand is provocative factor for suicidal attempts in newly married females. Dupatta is the most commonly used ligature material for hanging used by females and rope by males. In 72% cases of suicidal hanging dribbling of saliva/salivary stains not observed. More vulnerable victims in suicidal hangings are housewives, labourers, students, farmers.

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**Contribution of Authors:** BG Chikhalkar and PB Waghmare had examined the cases. PB Waghmare had collected the data. BG Chikhalkar had provided guidance to PB Waghmare and contributed to writing and revising the manuscript. Both authors contributed to the study design and had full approval of the submitted version. Vd. AS Thote did statistical analysis of data.

**Ethical clearance:** The study work is conducted after the approval of Institute's Ethics Committee for Academic Research Projects, Grant Govt. Medical College Mumbai, India.

## REFERENCES

1. Sadock BJ, Sadock VA. Chapter 29.1, Suicide. Kaplan & Sadock's comprehensive textbook of Psychiatry. 7th ed. Philadelphia: Lippincott Williams & Wilkins; 2000. p. 4186, 4200-4201.
2. De Leo, D, Burgis, S, Bertolote, J, Kerkhof, AJFM, & Bille Brahe, U (2006). Definitions of Suicidal Behaviour: Lessons learned from the WHO/EURO Multicentre Study. Crisis. 27(1):4-15. Available from: URL:<https://doi.org/10.1027/0227-5910.27.1.4>
3. Pekka Saukko, Knight B. Knight's Forensic Pathology. 3rd ed. London: Arnold Publication; 2004. p. 384.
4. Modi JP. In. Mathiwaran K, Kannan K editors. A textbook of medical jurisprudence and toxicology. 24<sup>th</sup> ed. Haryana, India: LexisNexis; 2012. p. 445.
5. Universal's Criminal Manual. New Delhi, India: Universal Law Publishing Co. Pvt. Ltd; 2014. p. 517-8.
6. Suresh Kumar PN. An analysis of suicide attempters versus completers in Kerala. Indian Journal of Psychiatry 2004;46(2):144-149.
7. Kumar Sachil, Verma AK, Bhattacharya Sandeep, Rathore Shiuli. Trends in rates and methods of suicide in India. Egyptian Journal of Forensic Sciences 2013;3(3):75-80.
8. Bennett AT, Collins KA, Suicide: a ten-year retrospective study. Journal of Forensic Sciences 2000;45(6):1256-8.
9. Kanchan Tanuj. Day, week, month of suicide by hanging. J Indian Acad Forensic Med; 30(4):202-206.
10. Behera A, Balabantray JK, Nayak SR. Review of suicidal cases, A retrospective study. JIAFM 2005;(2):100-102.
11. Ambade VN, Godbole HV, Kukde HG. Suicidal and homicidal deaths: a comparative and circumstantial approach. J Forensic Leg Med 2007;14(5):253-60.
12. Panarat Sritus, Montip Tiensuwan, Suda Riengrojpitak. A retrospective study on suicide autopsy cases from Ramathibodi hospital in Bangkok Thailand. 2010: 25-28.
13. Kadu Sandeep, Asawa Rajshrikant, Medico legal evaluation of suicidal deaths in rural area. Journal of Forensic Medicine, Science and Law 2011;20(1):8-11.
14. Rodge Sidsel, Hougen PH, Poulsen K. Suicides in two Scandinavian capitals- a comparative study. Forensic Science International 1996;80:211-219.
15. Shields Lisa BE, Hunsaker DM, Hunsaker JC. Suicide: A ten-year retrospective review of Kentucky medical examiner cases. J Forensic Sci 2005;50(3):1-5.
16. Bagadia VN, Abhyankar RR, Shroff P, Mehta P, Doshi J, Chawla P. Suicidal behaviour: a clinical study. Indian J Psychiatry 1979;21:370-375.
17. Bhullar DS. Profile of unnatural female deaths between 18-30 years of age. JFMT 1997;8(3):5-8.
18. Ambade VN, Tumram Niles, Meshram Satin, Borkar Jaydeo. Ligature material in hanging deaths: The neglected area in forensic examination. Egyptian Journal of Forensic Sciences 2015;5(3):109-113.
19. Patel AP, Bansal A, Shah JV, Shah KA. Study of hanging cases in Ahmedabad region. JIAFM 2012;34(4):343-345.
20. Meera Th, M Bipin Kumar Singh. Pattern of neck findings in suicidal hanging- a study in Manipur. JIAFM 2011;33(4):352-354.





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### RESEARCH PAPER

# A study on the pattern of injuries in homicidal deaths at MBS hospital associated with Government Medical College Kota, Rajasthan

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**Background and aims:** Violence is a significant health problem, and culpable homicide is the severest form of violence and prevalent worldwide. There are several motives for committing a culpable homicide. The numbers of culpable homicide are increasing day by day due to rapid urbanisation, increase life stress, unemployment and drug addiction. The present study aims at determining the pattern of injuries in homicidal death in the Kota region. **Materials and methods:** The present study was conducted in the department of forensic medicine and toxicology at MBS hospital Kota for a period from Jan 2017 to Dec 2018. Homicidal deaths due to mechanical injuries were included in the study. Detail information regarding crime circumstances was sought out from police/magistrate inquest, complete history, treatment record and post mortem examination. Prior permission from the research review board and the ethical committee was obtained. **Results:** In the present study, 67 cases of homicide were studied. Head and face were observed as the most common body part targeted in 32(47.8%) deaths. Chest and the abdominal region was the preferable site for sharp injuries for 21 cases, followed by four subjects' neck. More than half, in 45 cases (67%), death occurred within 6 hours of the attack, out of which 32 deaths resulted from injuries inflicted over the neck and thoracoabdominal region with dangerous weapons and means. **Conclusion:** Patterns of injuries in homicidal death may be a helpful indicator, and law enforcement agencies and autopsy pathologist should do a detailed examination of injuries/wounds.

**Keywords:** Culpable homicide; head injury; sharp injuries.

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## INTRODUCTION

Homicide is defined as the killing of one human being by another human being. Homicide is the most serious crime, as

old as civilisation, and it is one of the leading causes of unnatural death<sup>1</sup>. Homicide is wilful killing that incorporates “mensrea”, the mental element of a person’s intention to commit a crime, and “actusreus”- actual execution or guilt.

The killing of an individual is the highest level of aggression in all cultures. Thus, homicide is not only the death of human being but also humanity.<sup>2</sup>

Day by day incidences of homicide is increasing due to changing lifestyle, unemployment, drug addiction and life stress. Investigation of homicide can never be complete without a meticulous autopsy examination. The pattern of homicidal deaths varies across different populations, across different regions and keeps changing with time due to change in societal trends and influences. The design of injuries in homicidal death may provide helpful information for law enforcement strategies. The role of the forensic expert is to help in the administration of justice. Medico-legal autopsies give the cause and manner of death and share necessary statistical data related to legal incidents in the cities and regions where the autopsies are conducted.

The detailed analysis and scientific interpretation of autopsy findings are imperative to reconstruct the crime scene. Autopsy surgeons not only help to conclude the cause of death of the victim by studying the dead body and co-relating with the circumstantial evidence but also help to complete the methods and means employed in these acts along with requisite detailing of the injuries inflicted, which plays a determinant role in framing charges in cases. Thus, helping the law to punish the person involved in committing the crime. Detailed examination of wounds helps in the prediction of the weapon used in the killing. The nature of the weapon used and the gravity of the injury inflicted together to play a decisive role in identifying the charges to be held against the accused, which further determine the punishment in each case.<sup>3</sup>

The Kota city is situated on the river bank, long railway track, connecting Delhi to Mumbai, and there is a dense jungle of Chambal also present. These all factors are favourable to commit a crime like homicide, and the numbers of homicidal deaths are more in the Kota region than in other parts of Rajasthan. This study's primary objectives were to analyse the information to determine the pattern of injuries in homicidal deaths in the Kota region.

## MATERIAL AND METHODS

The present study was conducted in the department of forensic medicine and toxicology at MBS hospital Kota from Jan 2017 to Dec 2018 after taking permission from the research review board and ethical committee and completing all due formalities. Out of 2013 cases at autopsy, 71 cases of homicidal death were reported.

Inclusion criteria: All homicidal deaths as a result of mechanical injuries were included. Exclusion criteria: Homicidal deaths due to poisoning and burn were excluded.

In this study, 67 cases of homicidal deaths due to mechanical injuries were included. Detail information regarding crime circumstances was sought out from police/magistrate inquest, complete history, treatment record and post mortem examination.

## RESULTS

In this two-year study, out of the 2013 total autopsied cases, 67(3.3%) cases of homicidal deaths due to mechanical injuries were included. Deaths due to poisoning and burn, two instances of each, were not included in this study (**Table 1**).

**Table 1** Year-wise distribution of culpable homicide

Year	Total autopsy	Homicide	Poison	Burn	Mechanical injuries
2017	970	34	01	01	32
2018	1043	37	01	01	35
Total	2013	71	02	02	67

Head and face were observed as the most common body part targeted with 32(47.8%) deaths due to fatal injuries on these parts of the victims, followed by a thoracoabdominal region

**Table 2** Frequency of homicide cases according to fatal injuries on body parts

Body part	No. of cases (%)
Head	32(47.8%)
Neck	06(8.9%)
Chest	13(19.4%)
Abdomen	14(20.9%)
Limbs	02(3.0%)

with 27(40.3%) cases and neck with 6(8.9%) cases. Fatal injuries in peripheral parts were observed only in 2(3.0%) cases (**Table 2**).

Abrasions were the least common fatal wounds on the head observed only in two cases. Two deaths of head injuries were observed due to fatal firearm injuries. Blunt weapons were used in most cases due to their easy availability and because most of the crime in our society was not very planned. Six deaths were observed due to injuries over the neck region, out of which four cases resulted from incised wounds and two deaths due to strangulation. Our study showed that 14 deaths resulted from fatal injuries in the abdominal region, and 13 deaths resulted from fatal chest injuries. Twenty-seven

deaths were observed due to fatal stab/incised wounds. Out of which, 25 homicidal deaths resulted from deadly injuries on the neck and thoracoabdominal region. Chest and abdominal area were the preferable site for sharp injuries, 21 cases followed

by neck cases. Deaths due to firearm injuries, out of which three fatal injuries on the abdominal region, two fatal injuries on the chest and head region (**Table 3**).

**Table 3** Fatal injuries (wounds) on body parts.

Body part	Abrasions	Bruises	Lacerations	Stab/incised	Firearm	Total
Head	02	05	23	00	02	32
Neck	02(PON)	00	00	04	00	06
Chest	00	00	00	11	02	13
Abdomen	00	01	00	10	03	14
Limbs	00	00	00	02	00	02
Total	04	06	23	27	07	67

PON = pressure over the neck

Out of 32 cases of head injuries, 28 cases had bruise and laceration (by blunt weapons) as fatal injuries, out of which 23 cases (n=28) were having fractures of craniofacial bones. The most common bone to be fractured was the parietal bone,

followed by the frontal bone. In five cases, there was a fracture of more than one skull bones were observed. Fracture of the base of the skull was observed only in one case (**Table 4**).

**Table 4** Pattern of fractures of skull bone (n=23)

Bone fracture	No of cases	Percentage
Frontal bone	05	21.7
Parietal bone	07	30.4
Temporal bone	03	13.3
Occipital bone	02	08.6
Base of skull	01	04.3
Multiple bones	05	21.7

Cranio-facial injuries were the most common cause of death in 32 cases, followed by haemorrhagic shock in 28 cases. Five deaths were due to complications of injuries, and two deaths were observed as a result of asphyxia.

This study showed that in more than half 45 cases (67%), death occurred within 6 hours of the attack, out of which 32 deaths (71%) were as a result of injuries inflicted over the neck and thoracoabdominal region with dangerous weapons and means, as shown in **Table 3 and 5**.

**Table 5** Time of survival of victims of culpable homicide

Time of survival	Head	Neck	Chest	Abdomen	Limbs	Total
Spot death	06	06	13	08	01	34
0 – 6 hrs	08	00	00	03	00	11
6- 12 hrs	06	00	00	01	01	08
>12 hrs	12	00	00	02	00	14
Total	32	06	13	14	02	67

This analysis reflects that injuries were presented over vital body parts and were sufficient to cause death in the ordinary course of nature, thus constituting the crime of culpable homicide amounting to murder.

Our study showed that the brain was the most common vital organ involved in 32 deaths followed by abdominal organs in 14 cases, out of which liver involved in 05 cases, spleen in 02 cases, both liver and spleen in 03 cases, intestine in 03 cases and renal organs in 01 cases. Out of 13 fatal chest injuries, the heart and lungs involved in 08 cases, the lungs in 03 cases and the heart in 02 cases. Out of 06 deaths due to neck injuries, 04 cases involved carotid arteries and vein and 02 cases resulting from asphyxia.

In this study, defence wounds present in 14 cases (20.8%). The most typical defence wounds were incised wounds followed by bruises. Defence wounds present primarily on the upper limbs.

## DISCUSSION

Various injuries in homicidal deaths included assault by a sharp weapon, blunt weapon, firearms weapon, strangulation, smothering, burn and poisoning. The incidence of homicide is increasing day by day in different parts of the country, and the pattern of injuries in homicidal deaths also keeps changing with time. Because of the escalating magnitude and frequency of such deaths and their negative impact on society, the present study was done to study the patterns of injuries in homicide.

This study was undertaken to analyse the pattern of injuries in culpable homicidal deaths, excluding deaths due to poisoning and burn. Total 71(3.5%) homicidal deaths were observed, out of which 67(3.3%) deaths resulted from mechanical forces. Findings of our study consist of various other Indian studies.<sup>2-4</sup>

The most common body part involved was head and face, 32 cases; these results consist of other studies.<sup>1,3,5</sup> As the head is an essential part of the body, it is not a surprise that it is a fatal attack site. The common fatal injury observed was laceration, followed by incised/stab wounds. The findings consist of the study of Prashanth Mada et al.,<sup>6</sup> and Sachin S. Sonawane et al.,<sup>7</sup> and contrary to the study of Sandip Jhaveri et al.<sup>8</sup>

In stab/ incised injuries, the abdomen and chest were observed almost the same number of cases,<sup>10,11</sup> respectively. Total 27 cases of fatal stab/ incised wounds were surveyed, out of which 21 deaths (n=27) due to fatal injuries over the thoracoabdominal region. Similar findings followed by Patel DJ5 and Murray et al.<sup>9</sup>

In our study, about 80% of victims (53 cases) died within 12 hours of infliction of injuries, out of which 45 victims died within 6 hours of infliction of injuries, and 34 (about 51%) victims died on the spot. Karthik S K et al.,<sup>10</sup> also observed similar findings (56% spot deaths) in their study.

The most common cause of death was craniofacial injuries (47.8%). These findings consisted of the study of Prashanth Mada et al.,<sup>6</sup> and contradicted the study of Parmar DJ et al.,<sup>2</sup> in which the most common cause of death was a shock due to stab injury.

In this study, defence wounds were present in 20.8% cases consistent with a survey of Parmar DJ et al.,<sup>2</sup> but contradicted the result of Patel DJ5 (35.4%) and Sonawane SS et al.,<sup>7</sup> (42.4%).

## CONCLUSION

Culpable homicide is the worst form of crime. The concerned bodies should take a firm step to control this heinous crime. A study of the pattern of injuries in homicidal death may be a valuable indicator for law enforcement agencies and autopsy pathologist. In this study, head and face were mainly attacked by blunt weapons, neck and thoracoabdominal region primarily targeted by sharp weapons. More than half of victims died within 6 hours of infliction of injuries. Defence wounds were present in about 21% of deaths.

**Recommendations:** Strict enforcement of law should have ensued on possession of sharp/firearm weapons. Medical persons should appropriately manage injuries in the vital region/vital organs. The pattern of injuries is suggestive of the manner of death, so a detailed examination of injuries/ wounds should be done by an autopsy pathologist and investigating officer should work/coordinate with the autopsy pathologist in solving homicides.

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**Ethical clearance:** Obtained from the 'Institutional Ethics Committee'.

## Authors' Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

## REFERENCES

1. Verma LC, Punia RK, Yadav A. Analysis of homicidal deaths at SMS hospital, Jaipur. Medico-legal Update Aug



- 2014;14(2):72-76.
2. Parmar DJ, Bhagora LR, Parmar RD, Suvera KM. Recent trends of homicidal deaths in Bhavnagar Region- A two years retrospective study. *International Archives of Integrated Medicine* Aug 2015;2(8):45-54.
  3. Verma L, Punia RK, Sharma DK, Pathak D. Analysis of weapons used in homicide in Jaipur Region- A Three years study. *J. Evid. Based Med. Healthc* April 2016;5(16):1362-5.
  4. Hugar BS, Chandra G, Harish S. Pattern of homicidal deaths. *Journal of Indian Academy of Forensic Medicine* July 2010;32(3):194-8.
  5. Patel DJ. Analysis of homicidal deaths in and around Bastar Region of Chattisgarh. *Journal of Indian Academy of Forensic Medicine* April- June 2012;34(2):139-44.
  6. Mada P, Krishana PH. A comprehensive study on homicidal deaths in Hyderabad. *Journal of Indian Academy of Forensic Medicine* Oct-Dec 2013;2(8):971-974.
  7. Sonawane SS, Sukhadev RB, Tyagi S, Kolle SR. Autopsy evolution of homicidal death in western Mumbai region- 2 years study. *Sch J App Med Sci* Dec 2017;5(12A):4840-6.
  8. J haveri S, Raloti S, Patel R, Brahbhatt J. Profile of homicide; a three-year study at Surat municipal institute of medical education and research Surat During 2011-2013. *Community Med* 2014;5(4):406-9.
  9. Murray LA, Green MA. Hilt and knife: A survey of 10 years of fatal stabbing. *Med Sci Law* 1987;27:182-4.
  10. Karthik SK, Balaji PA, Syed Sodatali, Jayaprakash G, Mohan Velu J. Analysis of homicidal deaths in Bangalore city, India. *Indian Journal of Forensic Medicine and Toxicology* Dec 2012;6(2):64-7.



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### RESEARCH PAPER

# Impact of Covid 19 in medical education

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Prof.(Dr.) Ankumoni Saikia*

**Background and aims:** Covid 19 has created havoc in the world. Its impact has been seen in every sphere of life including education. Medical education is also effected as a result of this pandemic. This study is aimed to find out impact of this pandemic in medical education and possible effects of changes in medical education. **Materials and methods:** The study was conducted in Gauhati Medical College, Guwahati in May, 2020. A questionnaire was prepared to collect data from faculties, residents and undergraduate students. It included questions relating to impact, use of technology, online teaching, face to face teaching, learning environment, self directed learning, communication and social skills, evaluation and future of medical education. A five point Likert Scale was used to record their responses. **Results:** Seventy five subjects responded (31 faculties, 44 students, 35 females, 40 males). 74(98.7%) agreed that medical education is hampered. All (100%) agreed adaption to technologies. Sixty respondents (80%) found online teaching helpful. 71 respondents (94.7%) found limitations in online teaching. 55 respondents (73.3%) found online didactic lecture helpful. 90.1% found found online tutorial useful. 65(86.7%) believe small group discussion in virtual setting. 71(94.7%) respondents believe on face to face teaching. 68 (90.7%) agreed upon asynchronous learning. 66(88%) suggested small group discussion maintaining social distance. 62(82.7%) advocated clinical skill training with PPE. All (100%) agreed learning in safe environments. Fifty-three respondents (70.7%) want deferral of bedside clinical skill training. 64 (85.3%) respondents favored deferring clinical posting. 56(74.7%) favored clinical skills training in modules, simulation or videos. 58(77.3%) agreed upon self directed learning. 67(89.3%) opined that communication skills can be taught by maintaining social distance. Ninety percent (68 respondents) believe it will be difficult to teach social skills like empathy, attitude etc. during pandemic. 97.3% agreed that students should be trained for educating society. 98.7% were in favor of evaluation of changes made. Sixty six (88%) opined on going back to earlier method. All respondents support combining virtual method with conventional teaching after pandemic. **Conclusion:** Covid-19 pandemic has forced us to review all aspects of medical education in terms of their feasibility and effectiveness. It is high time to deeply think about training of the future doctors. Some changes in methodology are necessary in current scenario. Help of online education and use of technology is the need of the hour.

**Keywords:** Medical education; Covid-19; impact; Likert scale.

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## INTRODUCTION

The ongoing Covid-19 pandemic has become a health threat for all. It has affected every sphere of our personal and professional life.<sup>1</sup> There has been extensive effect on medical education. Medical education methodology is known because of its uniqueness. The medical pedagogy comprises of training in knowledge, skill, attitude, behavior and communication. Some part of the training require contact with patients. In absence of patients it is difficult to train students in these areas. In many disasters like fire, bomb blast, earthquakes, flood etc. medical education continued in spite of possible dangers. But current pandemic situation is different. During this time both educators and learners may contact the virus or spread the virus unknowingly because of its high contagious nature.<sup>2</sup>

Social distancing is now a norm, So the other forms of teaching learning process where no direct patient involvement required are also hampered.<sup>1,2</sup> In such a situation medical education needs a rapid change from conventional methods of teaching to other forms of teaching.<sup>2-4</sup> At this point of transformation teachers and students are of opinion that medical education must be continued in greater interest of the society. How effectively it can be done by using different methodologies in this time of pandemic is a great question. Till now no study is available on this subject in this region. This study aims at finding out role of different methodologies to impart medical education in terms of knowledge, skill, attitude, behavior and communication in current pandemic situation.

## MATERIAL AND METHODS

The study was conducted in Gauhati Medical College and hospital, Guwahati between 1st May, 2020 to 15th May, 2020. A questionnaire was prepared on different aspects of feasible teaching methods in this time of pandemic to collect data from faculties and students. The questions were on impact of pandemic in medical education, adaption to technology, online teaching, conventional face to face teaching, teaching environment, self directed learning, attitude and communication skill training, evaluation and future of medical education. A five point 'Likert Scale' was used to record their responses as Strongly disagree-1, Disagree-2, Neither agree nor disagree-3, Agree-4 and Strongly agree-5.5. Knowledge can be delivered by didactic lecture, small group discussion and tutorials. Skill training requires physical examination, observing or assisting procedures. Attitude and communication training are taught at bedside. Faculties and postgraduate students and interns who are working in the hospital in this time of pandemic are randomly selected in their duty hours and questionnaires were distributed and requested them to fill them up in their own suitable time during. They were collected later on without having the responder's name or any identification sign in it. Statistical analysis of the findings were done.

A literature search done in pubmed, medline and google to find out relevant literature. Findings were discussed in the light of these literatures and a conclusion is made.

## RESULTS

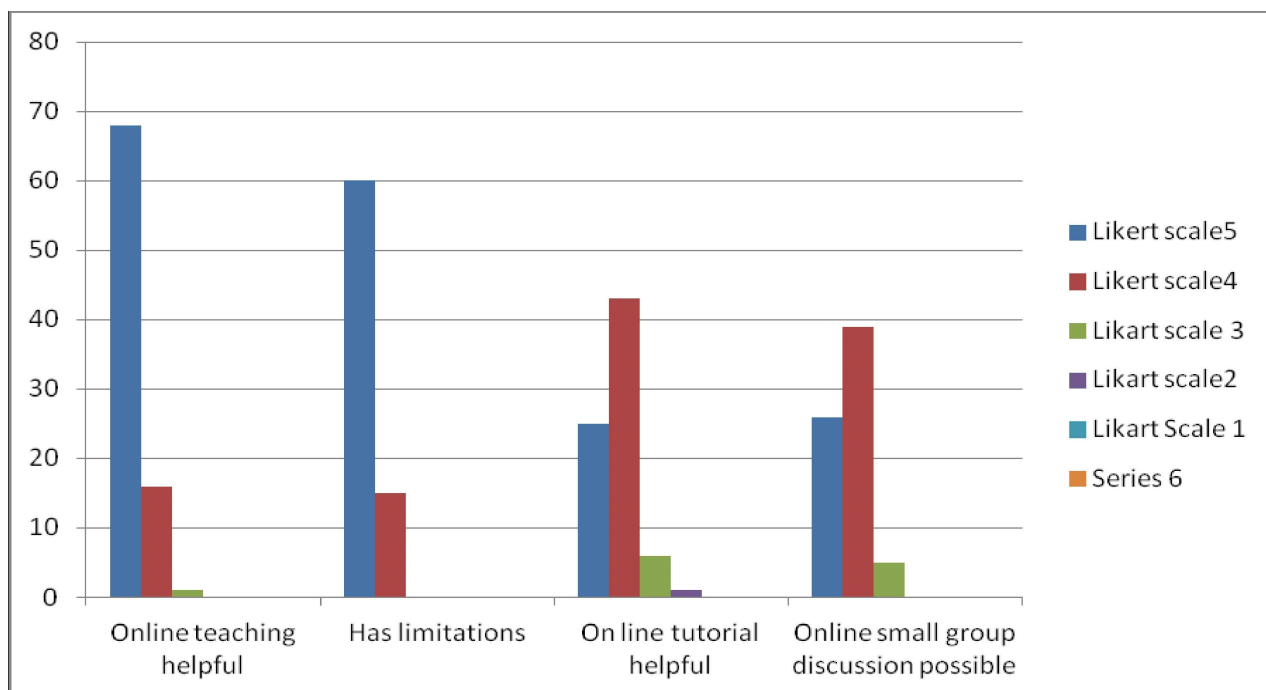
Seventy five subjects responded to the questionnaire out of which 31 were faculties and 44 were students (both postgraduates and undergraduates). Thirty five were females and forty were males. Seventy four (98.7%) respondents agreed that medical education is hampered by Covid 19 pandemic. Sixty eight ( 90.6% ) fully agreed and sixteen (21.3 %) agreed upon it. All respondents (100%) agreed that our medical program should now adapt to new technologies. Sixty respondents (80%) found online teaching helpful. At the same time 71 respondents (94.7%) found that online teaching has limitations. Fifty five respondents (73.3%) found online didactic lecture helpful and 90.1% found (68 respondents) that online tutorial is useful. Sixty five respondents (86.7%) believe that small group discussion is possible in virtual setting. Seventy one (94.7 %) respondents agreed that face to face training is important in medical education. Sixty eight respondents (90.7%) agreed that asynchronous learning is important in this time of epidemic. Sixty six (88%) suggested small group discussion maintaining social distance. Sixty two (82.7%) advocated physical examination skill training with proper PPE. All respondents (100%) agreed that learning should be always provided in safe environments. 53 respondents (70.7%) want deferral of bedside clinical skill training. 64 (85.3%) respondents favored deferring clinical posting. Sixty four (85.3%) respondents are in favor of deferring clinical posting to a period when normalcy returns. Fifty six (74.7%) respondents are of opinion that clinical skills training should be in modules, through simulation or interactive videos. Fifty eight (77.3%) respondents agreed that self directed learning will be very helpful in this time . Sixty seven respondents (89.3%) are of opinion that communication skills can be taught by maintaining social distance. Ninety percent (68 respondents) believe that it will be difficult to teach social skills of empathy, attitude etc. during this time of pandemic. Most of responders (73 respondents, 97.3%) agree that students should be trained for educating society. There is a strong opinion (74 respondents, 98.7%) in favor of evaluation of the changes from time to time. Sixty six (88%) respondents believe that once the epidemic is over the medical education should go back to earlier method of teaching. All respondents (100%) support an idea of combining virtual method with conventional teaching even when the pandemic is over.

## DISCUSSION

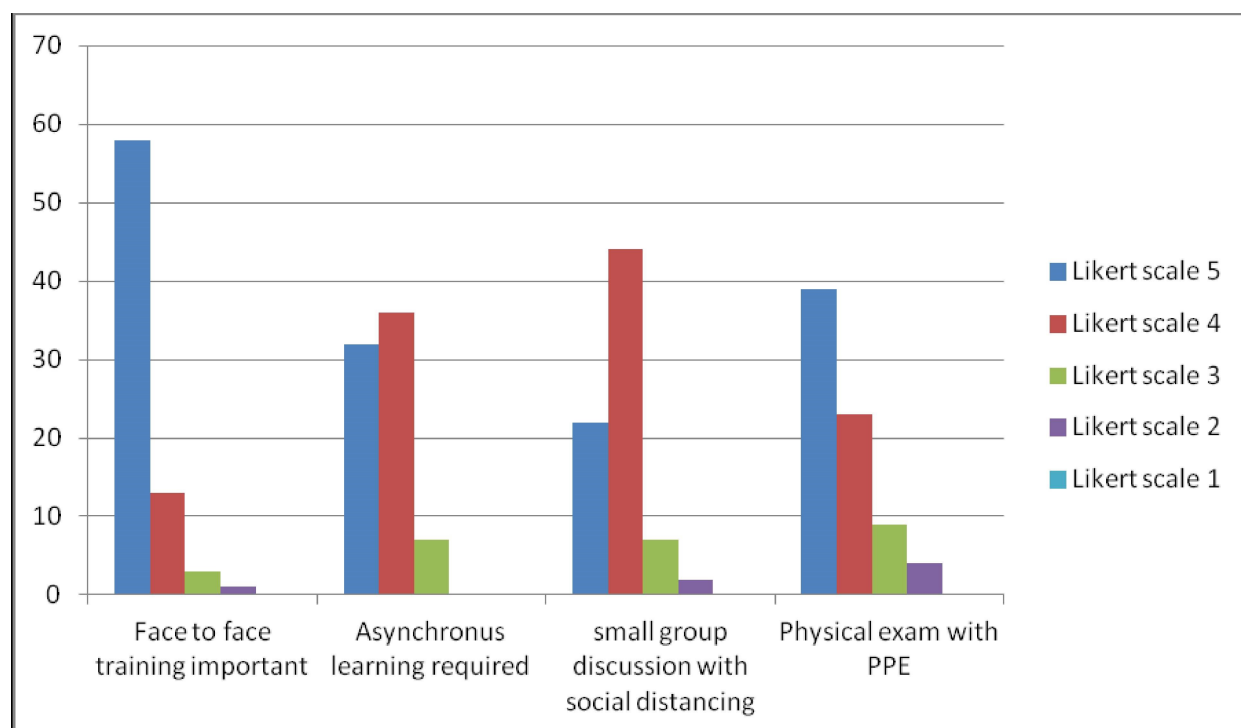
During pubmed, medline and keyword search in google no relevant research during the pandemic period was found. However, keywords search in google showed few articles relevant with the issues related to medical education in Covid 19 pandemic. Few scientific articles were also collected from pre-Covid period pertinent to some issues of the study.

At this time of transition students and educators should analyze effects of current changes and document it. Suzanne Rose says that it will help in learning of new principles which can be applicable in future settings.

There is gross disruption in medical education and training during this pandemic.<sup>4</sup> It has badly affected residency and fellowship training.<sup>6</sup> Medical educators are engaged in controlling the pandemic and it has reduced their teaching time.<sup>4</sup> Face to face academic activities are stopped for ensuring

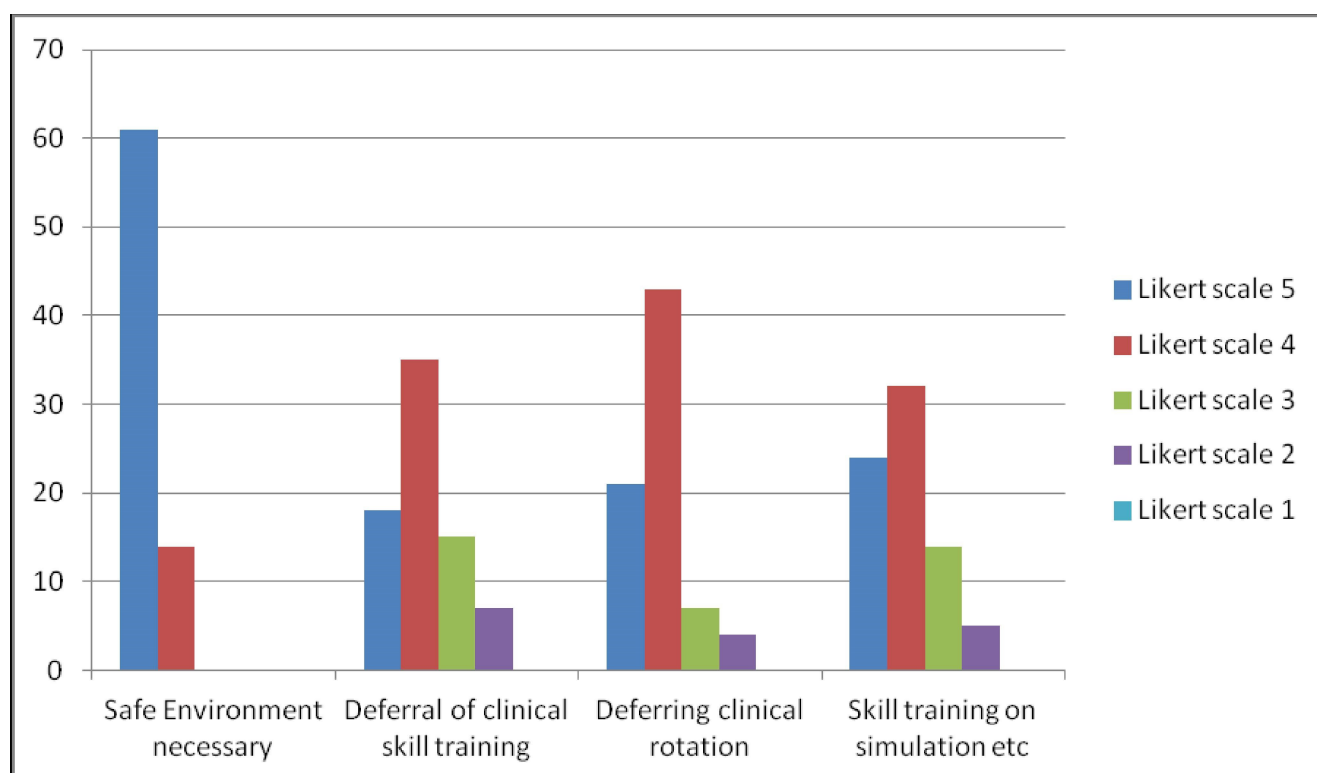


**Figure 1** Response on online teaching (Y axis: Number of respondents)



**Figure 2** Face to face teaching (Y axis: Number of respondents)





**Figure 3** Learning environment (Y axis: Number of respondents)

social distancing. Online teaching is encouraged.<sup>4</sup> All conferences, symposia, workshops, clinical attachment and visiting fellowship programs are cancelled.<sup>4</sup> As a result the academic atmosphere is affected.<sup>6</sup> Our region is also no exception to it. Sixty eight (90.6%) respondents fully agree and sixteen respondents (21.3%) agree that there is impact of Covid-19 in medical education. Disease control and patient care has become priority in this time of pandemic. Nicholas C Bambakidis et al.<sup>7</sup> wrote in an editorial that a balance between patient care and education priorities is needed at this time of pandemic.

Carnegie Foundation for the Advancement of Teaching reported a decade back that medical schools were working on transforming medical pedagogy by using technology to eliminate or reduce lectures.<sup>8,9</sup> However this transformation was very slow in many medical schools in India. Its importance is felt during this period of pandemic and medical educators and learners are putting emphasis on it. In this Covid-19 era there is a technological need for academic endeavors.<sup>6</sup> In this study all respondents agreed that technology should be incorporated in medical education. Eighty percent of our respondents fully agreed and twenty percent agreed to it. In streamed online lectures, technologies for screen capture and online dissemination are in use.<sup>4</sup> Other used technologies like Zoom (Zoom Video Communications, San Jose, California) and Slack (Slack Technologies, San Francisco, California)

need some improvement.<sup>6</sup> Emerging technologies like artificial intelligence for adaptive learning and virtual reality are likely to be an integral components for future medical education.<sup>4</sup> It is suggested that we should springboard on advances that are made during this period for improving our medical education.<sup>3</sup>

Online training has become relevant in this time of pandemic.<sup>6</sup> The advantage of online teaching is that it can be continued by maintaining social distance.<sup>3,4,6</sup> Online teaching includes learning from websites, online discussions forums, spaces, chat and different apps.<sup>4</sup> Virtual cases can be made available in online teaching.<sup>2</sup> Different online tools and platforms can be used for formative and summative assessments of students for core knowledge.<sup>4</sup>

Sixty respondents (80%) in the study found online teaching helpful. One advantage of this learning is that resources can be easily accessed from mobile devices.<sup>4</sup>

Didactic lecture is an important way of providing core knowledge to the students. In this study fifty five respondents (73.3%) found online didactic lecture helpful. Torda AJ et al. observed that students found online learning activities highly satisfying.<sup>3</sup>

Online tutorials are useful in current situation.<sup>4</sup> In this study 68 respondents (90.1%) found online tutorial useful. Suzanne says that if students are in telehealth environment, they can

learn critical situations.<sup>2</sup>

Small group discussion is an important method of learning in medical education. Many medical schools, professional bodies and education providers have developed modules and courses on line.<sup>4</sup> In this study sixty five respondents (86.7%) believe that small group discussion is possible in virtual setting. To make it possible faculties should be trained in technology.<sup>4</sup> Many small group discussions and tutorials are now replaced by interactive webinars.<sup>4</sup>

Online learning has many limitations too.<sup>3</sup> Seventy one respondents (94.7%) in the study agreed that online teaching has limitations. Actual feel of clinical experience is not possible in online learning.<sup>4</sup> Training in clinical skills, clinical encounters, interpersonal and inter professional communications is very essential in medical education.<sup>4</sup> It is more challenging where procedure based learning like in surgical specialties is essential for training.<sup>1</sup> Without a patient this is a major challenge for medical educators at present.<sup>4</sup> Few technologies like videos, podcasts, simple virtual reality, computer simulations and serious games can be used at present to fill this vacuum.<sup>4</sup> There is also a possibility of troubleshooting technical problems disrupting online learning.<sup>6</sup> Other hurdles for online teaching are faculty's unwillingness to embrace technology, costs (many technologies are often costly) and expertise.<sup>4,6</sup> Many open free educational resources (OER) are available online. Educators and learners can use them.<sup>4</sup>

In spite of availability of medical education resources on line, learning by dealing with patients is best method of learning. Many believe that online teaching and learning is now a compulsion created by Covid-19. In this study seventy one (94.7%) respondents agreed that face to face training is important. Learners opined in a study that they learned skills of history taking,<sup>7</sup> physical examination and clinical reasoning during bedside teaching where presence of a patient was mandatory.<sup>10</sup> Learning in form of role modeling is possible only in actual setting.<sup>2</sup>

Face to face learning experiences are not possible in virtual format.<sup>1</sup>

Asynchronous learning ("anytime/anywhere") is part of teaching in residency programmes. Many educators are using this method.<sup>2</sup> During this pandemic it is useful. In this study Sixty eight respondents (90.7%) agreed that asynchronous learning is important.

Small group interactions with social distancing is an idea which may be useful during the epidemic. In this study sixty eight respondents (90.7%) agreed that asynchronous learning is important.

Physical examination of a patient is a very important part of medical education. In a study done by K Ahmed et al ninety nine percent of students opined that they learned the skill at bedside on a patient.<sup>11</sup> It is difficult to say how much benefit

a student will get by doing examination of a patient with PPE. Theoretically it is possible. But, actual feel of palpation by bare hands will not be there in an examination with PPE. Auscultation will be a technically difficult to teach and other physical examinations will be very cumbersome to do with PPE. There is risk of transmission of virus too. Moreover shortage of PPE is a worldwide phenomenon. Whether PPEs are to be used for education rather than for treatment is also a matter of debate. Medical students were barred from entering into operation theatre to preserve PPE in University of Washington from March 6, 2020.<sup>1</sup> Training medical students in use of PPE was advocated in SARS (severe acute respiratory syndrome) pandemic in Singapore in 2003.<sup>1</sup>

An educator or a learner may contact the virus in course of training.<sup>2</sup> It is a challenge to create a safe environment in interest of patients, educators and learners.<sup>2</sup> All respondents in our study agreed on creating a safe environment. The Association of American Medical Colleges (AAMC) recommended that medical students should not come into contact with the patients during this epidemic.<sup>2,7</sup>

If it is to happen, clinical skill training should be deferred. In this study 53 respondents (70.7%) wanted deferral of bedside clinical skill training. Suzanne pointed out one option where clinical didactic lessons would be started online earlier and clinical skill training later when it is conducive.<sup>2</sup>

Skills can be trained in other ways. Fifty six (74.7%) respondents in this study opined that clinical skills training should be given in modules, through simulation or interactive videos.

An opinion based study done in UK, shows that clinical simulation is a good tool for learning clinical skills.<sup>12</sup>

Clinical rotation were deferred in Hong Kong in the SARS pandemic in 2003. It was deferred until new cases ceased.<sup>7</sup> It was done to protect students from contacting the virus and also to preserve PPE.<sup>7</sup> In this study 64(85.3%) respondents favored deferring of clinical posting. Suzanne Rose suggested modifying the academic calendar in such a way that initially scholarly knowledge on authentic patient experiences should be shared. Clinical rotations should be deferred.<sup>2</sup> Problem may arise later<sup>8</sup> because of two cohort classes of students (one with deferred rotation and another with normal rotation) in clinics causing density of learners at one point of time.<sup>2</sup>

Self directed learning is an active form of learning. Under guidance of the educator a learner can engage himself in learning. Fifty eight (77.3%) respondents in this study agree that self directed learning is helpful in present situation. Self-directed learning can promote individual and inter professional education.<sup>8,9</sup>

Training in interpersonal and communication skill is a part of medical education. Enough evidences are there to show that these skills play a significant role in patient care.<sup>13-16</sup> Students consider bedside teaching with a patient is very essential for

learning communication.<sup>17</sup> Sixty seven respondents (89.3%) in this study believe that this skill can be taught to students maintaining social distance with the patients.

Educators and learners are showing their empathy and altruism in different ways by caring patients, taking part in educating society and helping people in distress.

Altruism is learnt only in actual patients.<sup>2</sup> The humanistic approach to a patient is learnt at bedside during communication and it is a great tool for building trust between the patient and the clinician. The humanistic aspects of medicine cannot be taught in a classroom.<sup>18,19</sup> Ninety percent of respondents in this study believe that it will be difficult to teach social skills like empathy, attitude etc. during the pandemic.

The traditional way of showing empathy, altruism and other human compassionate behaviors must be redefined in this epidemic. As the disease is highly contagious any potential actions done in good intention with present culture of professionalism may cause harm. The situation is becoming more difficult because of limited availability of Covid 19 testings and PPE kits.<sup>2</sup>

Educators and learners are showing their empathy and altruism in different ways by caring patients, taking part in educating society and helping people in distress.<sup>2</sup> Suzanne Rose says that students can act as educators to their peers, patients, and communities in this pandemic. They can use social media and other available modalities to educate people in changing behaviors in the community in controlling the pandemic.<sup>2</sup> Seventy three (97.3%) respondents in this study agree that students should be trained in educating society.<sup>2</sup>

Any changes done in methods of training need subsequent evaluation.<sup>2</sup> In this study seventy four respondents (98.7%) are in favor of evaluation of the changing methods from time to time.

It is a common notion that one should learn from experiences and evaluation will help.<sup>2</sup>

Suzanne Rose suggests research publications for knowledge dissemination.<sup>2</sup> It is essential to analyse medical education in present scenario for making decisions about medical education in future.<sup>4</sup>

It is very uncertain to say that how long Covid-19 will prevail.<sup>2</sup> There is a possibility that people will have to live in a new normal environment where the virus will exist and use of mask, social distancing, quarantine and other anti covid measures will remain. In such a situation there will be a major change in future training of medical students.<sup>2</sup>

There is least possibility that medical education will return to previous approach once the epidemic is over. Technology will be used in teaching and learning in future.<sup>4</sup> This transformation will depend on outlook of concerned individuals and societies.<sup>4</sup> Both online and face to face teaching will fulfill expectation of the learners.<sup>3,6,9</sup>

In this study sixty six (88%) respondents believe that once the epidemic is over the medical education will go back to earlier method of teaching. But, all respondents (100%) support an idea of combining virtual method with conventional teaching even when the pandemic is over. The conversion will depend on the need of expanding clinical workforce in near future. Other factors like availability of educators, number of educators and economic status will also play a great role.<sup>4</sup>

The co relational research guidelines published by Capilano University says that there should be at least 30 or more participants in such type of studies.<sup>20</sup> This study comprises of seventy five respondents and it can briefly reflect opinions of the educators and students on medical education during and after the pandemic.

The results of this study will help policy makers, medical administrators, educators and learners to decide their future course of actions. This study was done in one tertiary care teaching institute. So the findings may not be universally applicable to all medical institutes. A large multicentre study with larger sample size and more questions in questionnaire will be more informative and useful.

## CONCLUSION

Covid 19 pandemic has forced us to review all aspects of medical education in terms of their feasibility and effectiveness. It is high time to deeply think about training of the future doctors. Some changes in methodology is necessary in current scenario. Help of online education and use of technology is the need of the hour. It is time to facilitate all forms of teaching methodology in a new situation of the Covid 19 epidemic and thereafter.

**Declarations:** There are no conflicts of interest.

**Ethics Statement:** This based is based on personal opinions and does not need Ethics Approval.

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## REFERENCES

1. Kristine E. Calhoun, Laura A. Yale, Mark E. Whipple, Suzanne Allen, Douglas E. Wood, Roger Tatum. The impact of COVID-19 on medical student surgical education: Implementing extreme pandemic response measures in a widely distributed surgical clerkship experience. *Am J Surg* 2020 Apr 28;doi: 10.1016/j.amjsurg.2020.04.024 [E pub ahead of print] PMID: PMC: 7186124. PMID: 32389331.
2. Suzanne Rose. Medical Student Education in the Time of COVID-19 *JAMA* Published online March 31, 2020 E1-210.
3. Torda AJ, Velan G, Perkovic V. The impact of COVID-19 pandemic on medical education. *Med J Aust* 2020; <https://www.mja.com.au/journal/2020/impact-covid-19-pandemic-medical-education> [Preprint, 14 May 2020]

4. Goh P, Sandars J, 2020, 'A vision of the use of technology in medical education after the COVID-19 pandemic', *MedEdPublish*, 9, [1], 49, <https://doi.org/10.15694/mep.2020.000049.1>
5. Gail M. Sullivan, Anthony R. Artino, Jr, Analysing and interpreting data from Linkert type scales. *J.Grad Med Educ*. 2013 Dec;5(4):541-2.
6. Zaid I. Almarzooq, Mathew Lopes, Ajar Kochar. Virtual Learning During the COVID-19 Pandemic A Disruptive Technology in Graduate Medical Education. *J Am Coll Cardiol* 2020 May 26;75(20):2635-8.
7. Nicholas C. Bambakidis MD and Krystal L. Tomei MD, MPH. Editorial, Impact of Covid-19 on neurosurgery resident training and education. *J Neurosurg* 2020 Apr; 1-2.
8. Irby DM, CookeM, O'Brien BC. Calls for reform of medical education by the Carnegie Foundation for the Advancement of Teaching: 1910 and 2010. *AcadMed* 2010;85(2):220-7.
9. Skochelak SE, Stack SJ. Creating the medical schools of the future. *Acad Med*. 2017;92(1):16-9. DOI:<https://doi.org/10.3171/2020.3.JNS20965> Online Publication Date: 17 Apr 2020
10. Celenza A, Rogers IR. Qualitative evaluation of a formal bedside clinical teaching programme in an emergency department. *Emerg Med J* 2006;23:769-73.
11. K Ahmed, Mel-B. What is happening to bedside clinical teaching. *Med Educ* 2002;36:1185-8.
12. Patric Jones, Bhavan Prasad Rai The status of bedside teaching in the United Kingdom : the student perspective, *Advances in Medical Education and Practice* 2015;6, 421-9.
13. Langlois JP, Thach S. Teaching at the bedside. *Fam Med* 2000;32:528-30.
14. Salam A, Ahmad FaizalMP, Siti HarnidaMI, et al. UKM medical graduates perception of their communication skills during housemanship. *Med Health*. 2008;3:54-8.
15. Rider EA, Keefer CH. Communication skills competencies: definitions and a teaching toolbox. *Medical Education*. 2006;40:624-9.
16. Nobile C, Drotar D. Research on the quality of parent-provider communication in pediatric care: implications and recommendations. *J Dev Behav Pediatr* 2003;24:279-90.
17. Leili Mosalanejad, Mohsen Hojjat, Morteza Gholami A holistic approach to bedside teaching from the views of main users. *Middle east J of nursing* 2014;8(1):24-30.
18. Istiaq Ali Khan Bedside teaching- Making it an effective instrumental tool. *J Ayub Med Coll Abbottabad* 2014;26(3):286-9.
19. Hartley S, Gill D, Carter F, Walters K, Bryant P. Teaching Medical Students in Primary and Secondary Care. *J R Soc Med* 2004 Jun;97(6):305.
20. Capilano University. Correlational Research Guidelines, [cited on 2021 March 10]. Available at: [www.capilanou.ca](http://www.capilanou.ca)





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### RESEARCH PAPER

# Giant juvenile fibroadenoma: experience from a rural medical college

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**Background and aims:** Fibroadenoma is one of the most typical benign breast lesions in our outpatient clinics. Giant Juvenile fibroadenoma (GJF), characterized by its alarming rapid growth and gross disfigurement, is less frequently identified. **Material and methods:** All fibroadenomas presented to the Outpatient Department from 2011 to 2016 were undertaken. Demographic data, duration of symptoms, size at presentation were noted. For diagnosis, radiological, cytological and histo-pathological modalities were used. Patients were treated by surgical excision and followed up. Three-Hundred-Ninety-Four cases were diagnosed as fibroadenoma by both clinical and radiological examinations and confirmed by FNAC. Patients with fibroadenomas <2cm in size were followed up regularly in the outpatients' department, while those >2cm underwent surgical excision. GJF were defined as those with >5cm in diameter. The data were analysed using the Statistical Package for the Social Studies (SPSS) version 22 (IBM Corp., Armonk, New York). Prior ethical clearance was taken from the institute's ethics committee. Informed consent was taken from the participants before the collection of the data. **Results:** The total number of excised fibroadenomas was 92(23%). GJF was diagnosed in 4 patients accounting for 4.3% of all excised fibroadenomas. Age ranged between 14-23 years. **Conclusion:** However benign these lesions may appear, because of the history of a sudden rapid breast enlargement as demonstrated in nearly all the clinical presentations, surgical excision remains the mainstay of treatment of such lesions to allow the previously compressed normal surrounding breast tissue to expand and retain its normal function and cosmetic appearance. Radiological modalities such as ultrasound and MRI may aid the diagnosis, limiting mammography to the older age group.

**Keywords:** Breast lesion; benign; premenarchal.

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## INTRODUCTION

Benign breast diseases are among the most significant proportion of breast complaints presenting to our Outpatient Department. Fibroadenomas, usually diagnosed by palpation

or by radiological investigations. They account for approximately 20% of open surgical breast excisions.<sup>1</sup> As they contain the same components as normal breast tissue, they enlarge during pregnancy and regress at menopause in response to hormonal changes. Their natural history is variable.

They usually grow to 2-3cm in diameter.<sup>1,2</sup> It is rare but possible to have malignancy within fibroadenomas.<sup>3</sup>

Giant juvenile fibroadenoma (GJF) are rare, about 5% of all breast tumours. They are common in young females in their teens or early 20s. Their rapid growth raises the suspicion of possible malignancy, and they do not become malignant but often unsightly and disturbing to the patient.<sup>2</sup>

### MATERIAL AND METHODS

This study was undertaken at Fakhruddin Ali Ahmed Medical College Hospital, Barpeta, Assam, from 2011 to 2016. Patients diagnosed with fibroadenomas who visited the Surgery Outpatient Department were included. Demographic data, duration of symptoms, size at presentation, radiological and cytological investigations and operative records were included. All patients underwent clinical examination, ultrasonography and FNAC.

Patients presenting with <2cm lumps in diameter were followed up regularly. Surgical excision was done to all patients presenting with lumps >2cm in diameter. Lesions >5cm in size were considered GJF and underwent total excision through a circum-areolar or inframammary incision, and meticulous care was taken to preserve the shape of the breast. Before the collection of the data, ethical clearance was obtained from the ethics committee.

### RESULTS

Total of 394 patients was diagnosed with fibroadenoma. Out of that, 92(23%) underwent excision. GJF was reported in 4 (4.3%) patients of 14-23 yrs age. The most typical presentation was rapidly growing painless breast mass within 5-8 months, with marked breast asymmetry, stretched overlying skin and dilated superficial veins average size was 7-15 cm in diameter.

Ultrasonography showed the presence of a large hypoechoic mass surrounded by compressed breast parenchyma yet failed to distinguish accurately between the lesion and the active breast tissue.

Hypercellular aspirate containing predominantly stromal cells with no atypia was seen in FNAC.

On gross appearance, mass was well encapsulated and thin-walled.

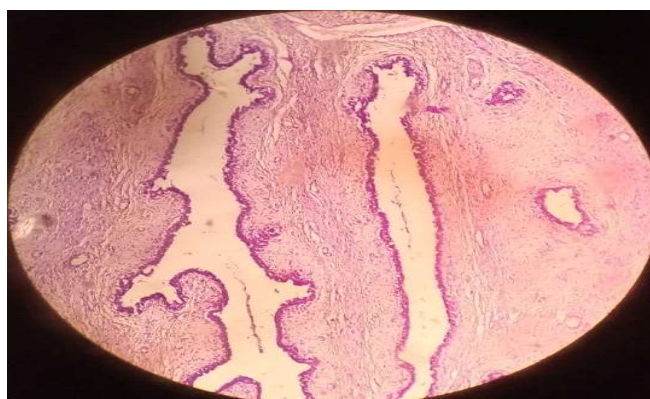
The characteristic appearance of the intracanalicular and pericanalicular growth patterns, dilated spaces, leaf-like projections, epithelial hyperplasia, and lack of stromal condensation was seen on histopathology. There was no recurrence in any of the patients during the follow-up period.



**Figure 3** The excised 15×20 cm lobulated, thin capsule, soft mass



**Figure 4(a)** Breast mass demonstrating proliferating glands and stroma with intracanalicular and pericanalicular patterns of growth, dilated spaces and leaf-like projection



**Figure 4b** High power demonstration of the above image

## DISCUSSION

Fibroadenomas are abnormality of normal development and involution; some can be managed without surgical intervention. If it grows more than 2 cm in size, surgery is considered to eliminate anxiety or compromise cosmetic appearance.<sup>1</sup>

GJF are less common, consist of around 5% of all breast tumours. They are usually solitary and, by definition, are more significant than 5 cm in size or weigh 500 grams.<sup>4</sup> They typically present in young females in their teens or early 20s. Their rapid growth raises the suspicion of malignancy. They never become malignant, though often unsightly and disturbing to the patient.<sup>2</sup> Rarely, their rapid enlargement may cause skin ulceration, but the skin is not adherent to the tumour.<sup>5</sup>

Cystosarcoma phyllodes may be confused with Giant juvenile fibroadenoma. They have even similar clinical presentation and cytological appearance. It may occur in ectopic breast tissue, commonly in the axillary region and, more rarely, the vulva and the inguinal areas.<sup>6</sup>

Many time it isn't easy to diagnose preoperatively, and in some instances, even on the frozen section. The diagnosis of Cystosarcoma phyllodes can be mainly based on increased stromal cellularity, pleomorphism, and the presence of mitotic figures.<sup>7</sup> Due to extensive areas of hemorrhagic necrosis, Phylloid tumours may rarely present with bloody nipple discharge.<sup>7,8</sup>

Juvenile gigantomastia can be another differential diagnosis of juvenile fibroadenoma. This is characterized by estrogen receptor-positive and its hypersensitivity to estrogen.<sup>9</sup>

Different benign breast lesions may occur in prepubertal female children. In a reported series of thirty-seven cases of benign breast lesions, with ages ranging between 7.5-11.5 years, fibroadenoma was the commonest, accounting for 22 (59.5%), juvenile fibroadenoma 9 (24.2%), virginal hypertrophy 3 (8.1%) and one case of osteosarcoma phyllodes 1 (2.7%), duct papilloma 1 (2.7%) and tuberculosis 1 (2.7%).<sup>10</sup>

Breast carcinoma is sporadic below 20 years. Invasive ductal carcinoma, secretory carcinomas, and invasive lobular-type carcinoma have sporadically been reported.<sup>4,11</sup> As fibroadenomas have progesterone and estrogen receptors, and they at least rely partly on these hormones to grow, similar to breast carcinoma. Exogenous estrogen therapy may be responsible for developing fibroadenomas as described in a case of a complete androgen insensitivity syndrome XY karyotype (CAIS) who received exogenous estrogen as replacement therapy after orchidectomy.<sup>2</sup> Multiple Juvenile fibroadenomas should be carefully managed as there is a risk of recurrence after local excision.<sup>12</sup> According to some authors, the security zone of mammary parenchyma is mandatory.<sup>13</sup>

Mammograms are not recommended for this age group. Ultrasonography usually shows a diffuse glandular process

that may or may not be distinct from the surrounding breast tissue. Radiographically it is challenging to distinguish juvenile fibroadenoma from cystosarcoma phyllodes.<sup>14</sup> MRI may accurately delineate additional lesions not demonstrated by conventional modalities.<sup>15</sup>

Non-surgical excisions like cryoablation for cytologically proven fibroadenomas have played a role in size reduction or total elimination of lesions with minimal scarring and patient satisfaction.<sup>1</sup> However, this method is slow (3-12 months) and tedious. Another non-surgical method is an ultrasonic guided vacuum-assisted biopsy. It is used for lesions of <2cm in diameter. For larger lesions, >2cm in diameter, the success rate is low. Consequently, some patients have had to undergo conventional surgical excision.<sup>16</sup>

Endoscopic resection of benign breast tumours and axillary dissection has gained some popularity in recent years. Both methods of using the anterior adipose tissue or retro mammary space have been equally reported. They provide superior cosmetic results with high levels of patient satisfaction. However, the mean duration of the surgery is 79 minutes with a mean hospital stay of 3.5 days compared to the conventional day- surgery procedure of the classical excision.<sup>17,18</sup>

In this study, teenage patients presented with rapidly growing benign breast lesion were included. Ultrasonography confirmed the presence of a sizeable hypoechoic mass surrounded by compressed breast parenchyma but failed to show details of the margins. FNAC and histopathology confirmed the diagnosis of GJF.

## CONCLUSION

Giant juvenile fibroadenoma is a condition of young females. The primary treatment is surgical excision. Meticulous care must be taken to attain the best cosmetic results and breast function or management outcome. The surgeon's preference and skills should determine the surgical approach.

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**Contribution of Authors:** We declared that this work was done by the authors named in this article and all liabilities about claims relating to the content

## REFERENCES

1. Kaufman CS, Bachman B, Ittrup PJ, White M, Carolin KA, Freeman-Gibb L, et al. Office-based ultrasound-guided cryoablation of the breast fibroadenomas. *Am J Surg* 2002;184:394-400.
2. Davis SE, Wallace AM. A 19-year-old with complete androgen insensitivity syndrome and Juvenile fibroadenoma of the breast. *Breast J* 2001;7(6):430-3.

3. Stafyla V, Kotsifopulos N, Grigoriades K, Kassaras G, Sakorafas G. Lobular carcinoma in situ of the breast within a fibroadenoma, case report. *Gynecol Oncol* 2004;94(2):572-4.
4. Musio F, Mozingo D, Otchy DP. Multiple giant fibroadenoma. *Am Surg* 1991;57:438-4.
5. Namiar R, Kutty K. Giant Fibroadenoma (cystosarcoma phyllodes) in adolescent females- a clinicopathological study. *Br J Surg* 1974;61:261-9.
6. Oshida K, Miyauchi M, Yamamoto N, Takeuchi T, Suzuki M, Nagashima T, et al. Phyllodes tumor arising in ectopic breast tissue of the axilla. *Breast Cancer* 2003;10(1):8284.
7. Briggs RM, Walters M, Rosenthal D. Cystosarcoma phyllodes in adolescent female patients. *Am J Surg* 1983;146:712-4.
8. Tagaya N, Kogure H, Shmizu K. A case of Phyllodes tumor with bloody nipple discharge in Juvenile patient. *Breast Cancer* 1999;6(3):207-10.
9. Morimoto T, Komaki K, Mori T, Sasa M, Miki H, Inoue H, et al. Juvenile gigantomastia: report of a case. *Surg Today* 1993;23(3):260-4.
10. Inder M, Vaishnav K, Mathur DR. Benign breast lesions in prepubertal female children: a study of 20 years. *J Indian Med Assoc* 2001;99(11):619-20.
11. Rivera-hueto F, Hevia-Vazquez A, Utrilla-Alcolea JC, Galera-Davidson H. Long term prognosis of teenagers with breast cancer. *Int J Surg Pathol* 2002;10(4):273-9.
12. Dike AM, Oberman HA. Juvenile (cellular) adenofibromas. A clinicopathological study. *Am J Pathol* 1985;9:730-6.
13. Remadi S, Ismail A, Karpuz V, Zacharie S, Vassilakos P. Cellular (juvenile) fibroadenoma of the breast. A clinicopathologic and immunohistochemical study of 7 cases. *Ann Pathol* 1994;14(6):392-7.
14. Simmons R, Cance W, Lacicca M. A giant juvenile fibroadenoma in a 12-year-old girl: A case report for breast conservation. *The breast J* 2000;6(6):418-20.
15. Diekmann F, Diekmann S, Beljavska M, Bick U, Taupitz M, Blohmer JU, et al. Preoperative MRT of the breast in invasive lobular carcinoma comparison with invasive ductal carcinoma. *Rofo* 2004;176(4):544-9.
16. Sperber F, Blank A, Metser U, Flusser G, Klausner JM, Lev-chlouche D. Diagnosis and treatment of breast fibroadenoma by ultrasonographic guided vacuum-assisted biopsy. *Arch Surg* 2003;38(7):796-800.
17. Kitamura K, Hashizume M, Kataoka A, et al. Trans axillary approach for endoscopic extirpation of benign breast tumors. *Surg laparosc endosc* 1998;8:277-9.
18. Takayuki O, Zenro N, Wataru I, Kenichi S. Endoscopic resection of benign breast tumors. Retromammary space approach. *Surg laprosc endosc* 2002;12:100-3.





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### RESEARCH PAPER

# Neutropenia in breast cancer patients receiving Paclitaxel as chemotherapy: a study in a tertiary care centre in Northeast India

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**Background and aims:** Chemotherapy-induced neutropenia (CIN) is one of the most common side effects in breast cancer patients receiving myelosuppressive chemotherapy like Paclitaxel which adversely affect patient outcomes. **Materials and methods:** A single centre, retrospective, observational study was conducted on 210 breast cancer patients with prior adequate bone marrow, hepatic and renal functions, receiving Paclitaxel as neoadjuvant or adjuvant or palliative chemotherapy from January 2018 to April 2019 at State Cancer Institute (SCI), Guwahati, Assam, India. Patients with a history of taking immunosuppressive agents, immunodeficiency states, hematological disease and any intercurrent illness were excluded from this study. Paclitaxel was given two weekly for four cycles at a dose of 175mg/m<sup>2</sup> in each cycle. A total of 836 cycles were observed for 210 patients, while four patients did not complete the last cycle due to peripheral neuropathy. **Results:** The average age of the patients was 49.44±9.13 years. Among 210 patients, 82 patients presented with neutropenia (39.02%), while total neutropenia episodes were 128 (15.31%). Seven patients presented with febrile neutropenia (FN) out of 82 patients who received Paclitaxel (8.54 %). Prior incidence of CIN, advanced age, poor performance status and lower baseline Hb% were found as risk factors for CIN. **Conclusion:** The incidence of CIN and CIN episodes was 39.02% and 15.31%, respectively, in our study. Hence judicious use of Granulocyte colony-stimulating factor (G-CSF) as prophylaxis in our populations with close monitoring and as needed may be undertaken. However, the limitations of our study were the small sample size. Hence, further studies are necessary for a large scale population to confirm the findings of our research.

**Keywords:** Chemotherapy-induced neutropeni; Paclitaxel; North-East India.

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## INTRODUCTION

Breast cancer is the most commonly occurring cancer in women in developed and developing countries like India and the second most common cancer worldwide after lung cancer. According to Global Burden of Cancer (GLOBOCAN) study

2018, there were over 2 million new breast cancer cases were reported in 2018 worldwide.<sup>1</sup>

Indian Council for Medical Research [ICMR] has reported 1.5 lakhs of new breast cancer cases in India per year. Chemotherapy is one of the mainstays in the management of

breast cancer. Paclitaxel is an effective anticancer agent derived from the bark of *Taxus brevifolia* Nut (Taxaceae) and forms one of the most commonly use chemotherapeutic agents in breast cancer management in various settings like neoadjuvant, adjuvant or palliative setting.<sup>2</sup>

Myelosuppression is a significant dose-limiting side effect of Paclitaxel manifested as anemia, neutropenia, thrombocytopenia or a combination of any of these. Paclitaxel induces troublesome neutropenia of grade 3-4 in the dose range of 150-250 mg/m<sup>2</sup> in more than 50% of the patients. According to the Common Terminology Criteria for Adverse Events version 4.0 (CTCAE v 4.0), neutropenia is defined by a granulocyte count below  $1.5 \times 10^9/L$  (**Table 1**). CIN increases the risk of infection which is typically manifested by fever. When neutropenic patients develop fever, i.e. FN, the likelihood of infection and serious consequences often necessitates immediate hospitalization for urgent evaluation, ongoing monitoring, and empirical administration of broad-spectrum intravenous antibiotics.<sup>3</sup>

The management of CIN often mandate the use of G-CSF other than chemotherapeutics dose reduction, dose delay and discontinuation of chemotherapeutic agents, which seriously interfere with the delivery of optimal treatment and possibly adversely affecting patient outcome.<sup>4,5</sup>

SCI, Guwahati is one of India's North-Eastern region's tertiary care oncology centers, providing comprehensive oncology services to the patients of this regions; however, data regarding neutropenia in breast cancer patients from this part of India is limited. With the knowledge from the existing literature, we have aimed to investigate the profile of CIN in breast cancer patients receiving Paclitaxel; use of G-CSF in neutropenic breast cancer patients of North-east populations receiving Paclitaxel as chemotherapy and to evaluate the association of CIN with other baseline patient characteristics.

## MATERIAL AND METHODS

The present study is a single centre hospital-based retrospective observational study done at SCI, Guwahati, Assam, India.

### Study population:

All breast cancer patients with adequate baseline bone marrow, hepatic and renal functions who develop neutropenia after receiving Paclitaxel as neoadjuvant or adjuvant or palliative chemotherapy under the Medical Oncology department at SCI Guwahati from January 2018 to April 2019 over 16 months were included in the study. Patient with a history of taking immunosuppressive drug or patient with immunodeficiency status or any hematological diseases or any intercurrent illness were excluded from the study.

Paclitaxel was given two weekly for four cycles at a dose of 175mg/m<sup>2</sup>/cycle. Long-acting G-CSF, like injection pegfilgrastin 6 mg, was used subcutaneously for both primary

### Neutropenia in breast cancer patients receiving Paclitaxel as chemotherapy

and secondary prevention of neutropenia. In contrast, short-acting G-CSF, like injection filgrastin 300 mcg, was used to treat neutropenia for 7-10 days or till absolute neutrophil count (ANC) > 3000/dl.

Data were collected on following parameters:

i) Patient's characteristics: age, sex, menopausal status, Eastern Co-operative Oncology group Performance Status (ECOG-PS), chemotherapy setting, hormone receptor (HR) status and other laboratory parameters like baseline haemoglobin, total count and platelet count.

ii) Neutropenic status: symptomatology, grade of neutropenia, episodes of FN.

iii) Subsequent dose reduction, dose delay or suspension of chemotherapy in neutropenic patients.

iv) Use of G-CSF.

**Table 1:** Common Terminology Criteria for Adverse Events Version 4.0 (CTCAE v 4.0) grading of Chemotherapy-Induced Neutropenia (CIN)

Grade of Neutropenia	Absolute Neutrophil Count
Grade 1	Lower Limit of Normal -1500/ $\mu$ L
Grade 2	1000-1500/ $\mu$ L
Grade 3	500-1000/ $\mu$ L
Grade 4	<500/ $\mu$ L

### Statistical analysis:

Baseline characteristics of the study participants are expressed in mean  $\pm$ SD. Correlations were observed by using Pearson's correlation co-efficient. The results were considered significant when the probability (p-value) was less than 0.05% of the observed values of "t" at a particular degree of freedom. Statistical analysis was done using GraphPad InStat version 3.00. All the statistical graphs were prepared using Microsoft Excel 2007 (Microsoft Corporation, Redmond, WA). Prior ethical clearance was taken from the institute's ethics committee SCI of GMCH, Guwahati, Assam Vide Ref. No. SCI/ECR/2020/02 dated 02/05/2020.

## RESULTS

A total of 210 breast cancer patients were included in the study, with a mean age of  $49.44 \pm 9.13$  years at diagnosis. The female to male ratio was 208:2. The majority of female patients were postmenopausal (56.19%). Total 836 cycles of Paclitaxel were observed in 210 patients, with four patients who did not complete the last cycle due to peripheral neuropathy. (Table 2 and 3)

### Incidence of CIN:

Among 210 breast cancer patients who received paclitaxel, 82 patients (39.05%) developed CIN. A total of 128 (15.24%) episodes of CIN were documented. The majority of

neutropenic breast cancer patients had the triple-negative disease (n=27, 32.93%), and a majority (n=48 episodes, 38.28%) received Paclitaxel in palliative setting followed by adjuvant (31.42%) and neoadjuvant (29.52%) setting. Grade I neutropenia (51.22%) was most common among

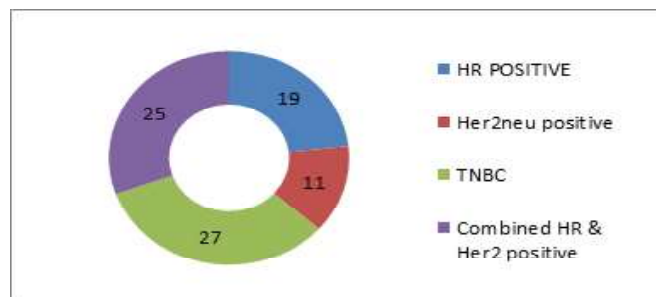
neutropenic patients, followed by Grade III (18.29%) and Grade II neutropenia (17.07%). A total of 7 (8.54%) patients presented with FN. Among seven FN patients, six had grade IV neutropenia, while one patient had grade III neutropenia. (Figure 1 and Table 3)

**Table 2** Baseline clinical characteristics

Serial No.	Parameters	Number (%)
1.	Total number of patients Included	210
2.	Age of presentation (years)	49.44±9.13 years
3.	Sex:	
	Male	2
	Female	208
4.	Menopausal status:	
	Premenopausal	43.81%
	Postmenopausal	56.19%
6.	Baseline receptor Status	
	HR positive	117 (55.71%)
	Her2neu positive	65 (31.42%)
	TNBC	43 (20.47%)
	Combined HR & Her2neu positive	83 (39.52%)
7.	Baseline hematological parameters	
	Hemoglobin (gm %)	11.2±2.1 gm%
	Total count (109/L)	7.6±3.3 ×109/L
	Platelet count (109/L)	2.8±1.45 × 109/L

#### Incidence of CIN:

Among 210 breast cancer patients who received paclitaxel, 82 patients (39.05%) developed CIN. A total of 128 (15.24%) episodes of CIN were documented. The majority of neutropenic breast cancer patients had the triple-negative disease (n=27, 32.93%), and a majority (n=48 episodes, 38.28%) received Paclitaxel in palliative setting followed by adjuvant (31.42%) and neoadjuvant (29.52%) setting. Grade I neutropenia (51.22%) was most common among neutropenic patients, followed by Grade III (18.29%) and Grade II neutropenia (17.07%). A total of 7 (8.54%) patients presented with FN. Among seven FN patients, six had grade IV neutropenia, while one patient had grade III neutropenia. (Figure 1 and Table 3)



**Figure 1** Receptor status in Neutropenic patients

**Table 3** Neutropenic events in the present study

Sl. No.	Parameters	No.(n=210)
1.	Total no. of patients developing CIN	82 (39.05%)
2.	Grades of Neutropenia	
	Grade I	42 (51.22%)
	Grade II	14 (17.07%)
	Grade III	15 (18.29%)
	Grade IV	11 (13.41%)
3.	Total episodes of CIN	128 (15.24%)
4.	Patients presented with FN	7 (8.54%)
5.	Chemotherapy setting in Neutropenic patients	
	Neoadjuvant	37 (28.90%)
	Adjuvant	43 (33.59%)
	Palliative	48 (37.5%)

**Abbreviations:** HR- Hormone receptor; Her2neu- Human epidermal growth factor 2; TNBC- Triple-negative breast cancer]

Most of the CIN patients were asymptomatic at presentation, while 9 patients presented with fever and 3 patients presented with diarrhoea.

**Risk factors of CIN:** Patient with advanced age (>60 years), poor ECOG-PS (e"2), comorbidities like baseline anemia and neutropenia and disease in advanced stage (i.e. receiving chemotherapy in palliative setting) are at a higher risk of developing CIN, as shown in Table 4.

**Table 4** Association of chemotherapy induced neutropenia with other baseline factors

Parameters		No. of CIN patients	p-value
Age group	< 40 years	12 (14.63%)	p=0.038 r=0.39
	40-60 years	26 (31.7%)	
	>60 years	44 (53.65%)	
Baseline Hb status (%)	8-10 %	61 (74.39%)	p=0.022 r=0.55
	< 8gm %	21 (25.60%)	
History of prior CIN		38 (46.38%)	

**Impact of CIN on chemotherapy schedule and use of G-CSF:** Patients with FN were hospitalized and treated with injectable antibiotics and G-CSF support as per institutional protocol with temporary withhold of chemotherapy. Patients

with grade III CIN received G-CSF, and in them, the chemotherapy schedule was delayed. Patient with grade 2 CIN received chemotherapy at a reduced dose while there is no dose reduction or delay in grade I CIN.

**Table 5** Neutropenic episodes following paclitaxel in the study

Following	Following Cycle 1	Following Cycle 2	Following Cycle 3	Following Cycle 4	Total (n)
Grade 1	2	19	17	4	42
Grade 2	2	7	4	1	14
Grade 3	1	4	8	2	15
Grade 4	1	3	6	1	11
Total	6	33	35	8	82

Among the 82 patients who developed CIN, 25 patients (30.49%) experienced dose delay while 14 patients (17.07%) experienced dose reduction. There was greater occurrence of neutropenia following the 3rd cycle followed by the 2<sup>nd</sup> cycle of Paclitaxel (**Table 5**). The mean duration of neutropenia was 5±3 days. CIN was the most common cause

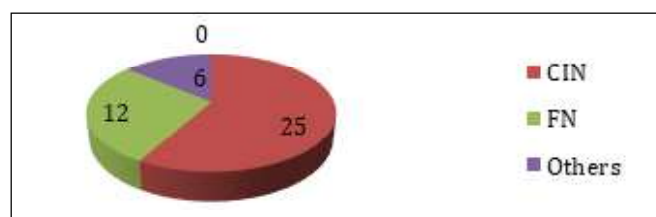
of temporary suspension of chemotherapy (**Figure 2**); a delay of about 7±2 days occurred between cycles. In no patient, chemotherapy was completely discontinued due to CIN.

[**Abbreviations:** CIN- Chemotherapy-induced neutropenia; FN- Febrile neutropenia]

In the present study, G-CSF was used in the highest number for secondary prevention (n=23, 28.05%) of neutropenia followed by treatment of neutropenia (n=15, 18.29%). Simultaneously, only one patient received G-CSF for primary prevention of neutropenia (**Table 6**).

## DISCUSSION

Breast cancer is the 2<sup>nd</sup> most common cancer worldwide and the most common cancer in female. In general, breast cancer has been reported to occur a decade earlier in Indian patients than their Western counterparts. Although most



**Figure 2** Reason for the delay between the chemotherapy cycles.



**Table 6** Use of Granulocyte-Colony Stimulating Factor (G-CSF) in various setting in the study

Indication of G-CSF in Neutropenic patients	Number (%)
As primary prophylaxis of CIN	1 (1.22%)
As secondary prophylaxis of CIN	23 (28.04%)
Treatment of neutropenia	15 (18.29%)

patients with breast cancer in Western countries are postmenopausal and in their 60s and 70s, the picture is quite different in India.<sup>6,7</sup> More than 80% of Indian patients are younger than 60 years of age.<sup>8</sup> The average age of patients with breast cancer has been reported to be 50 to 53 years in various population-based studies done in different parts of the country.<sup>9,10</sup> In the present study, we have documented a median age of  $49.33 \pm 9.13$  years which is similar to the survey by Gogia A et al.<sup>11</sup> In studies from Western countries, the median age of presentation was 55-60 years.<sup>6,7</sup> The present study documented that approximately 43.81% of patients were premenopausal and 56.19% were postmenopausal, whereas researchers from the Western world recorded 70% to 80% postmenopausal patients.<sup>6,7</sup>

In this study, HR status was positive in 55.71% (n=117) of patients; previous studies documented approximately 49% to 68% of HR-positive status.<sup>6,7,11</sup> The incidence of TNBC in the present study was 20.47% (n=43) which is higher than the survey by Kunikullaya SU et al. (16%).<sup>12</sup>

The development of neutropenia during chemotherapy is influenced as much as by the characteristics of the drug used as by the conditions presented by the patient. Although the risk factors for neutropenia during chemotherapy with Paclitaxel in breast cancer patients is not well defined, current studies found advanced age (> 60 years), low ECOG PS (e"2), reduction in haemoglobin and total count before starting Paclitaxel as a significant risk factor for the development of subsequent CIN.

The incidence of neutropenia in the present study was 39.02% (n=82) which is quite different as reported by another researcher, i.e., 10-34% by Schwenkglenks M et al., and Chia VM et al., 46.4% by Xuan Ye et al., in Chinese patients, 50.50% by Yasunori Hashiguchi et al., in Japanese patients and 63.3% by Talita Gracia do Nascimento et al., in Brazilian patients.<sup>13,14,15, 16, 17</sup> Incidence of FN in the present study was 8.54%. In comparison, it was 6.9% in the survey by Yasunori Hashiguchi et al.<sup>16</sup> In our research, we found that neutropenia was more when Paclitaxel was used in a palliative setting, but Talita Gracia do Nascimento et al., in their study found that it was common in the adjuvant setting.<sup>17</sup> Among the 128 episodes of neutropenia, grade 1 neutropenia was most common, followed by grade 3 and grade 2, which was similar

to the study by Talita Gracia do Nascimento et al.<sup>17</sup> There was greater occurrence of neutropenia following 2<sup>nd</sup> and 3<sup>rd</sup> of Paclitaxel in the present study. In contrast, Derek Weycker et al., in their research, found that it was common following 3<sup>rd</sup> cycle of chemotherapy.<sup>18</sup> In the current research, G-CSF was used in the highest number (n=23, 28.05%) for secondary prevention of neutropenia, which is similar to findings in the study by Derek Weycker et al. but Xuan Ye et al. in his research on Chinese patients found that use of G-CSF was highest in treatment of CIN and lowest for secondary prevention of CIN (1.9%).<sup>18,15</sup> CIN was the most common cause of temporary suspension of chemotherapy (28.05%) which is similar to the study by Xuan Ye et al.<sup>15</sup> The mean duration of neutropenia was  $5 \pm 3$  days which is identical to the survey by Yasunori Hashiguchi et al.<sup>16</sup>

## CONCLUSION

In the study, we have found that most of the patient were younger age and premenopausal at presentation and in the productive years of their life. CIN is fairly common in breast cancer patients receiving Paclitaxel, by identifying risk factors, such as elderly age group, baseline anemia, poor performance status, disseminated disease or distant metastatic disease, the safe management of chemotherapy-induced neutropenia may be possible in patients. Although delays or reductions of chemotherapy dose minimize the myelotoxicity, these actions can negatively impact the result of the treatment, on overall survival and must be avoided as much as possible.

**Limitation of the study:** A limitation in our study is that the study population was less, so we advocate for further studies with a large number of patients over a longer duration of the period.

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**Conflict of interest:** No conflict of interest associated with this work.

**Contributions of authors:** We declare that we did the study, and we will bear all liabilities about claims relating to this article's content. **Conception and design:** Dr. Naba K. Kalita, Dr. Hitesh Deka. **Collection of data:** Dr. Naba Kumar Kalita, Dr. Pranjit Moral, Dr. Hitesh Deka. **Data analysis and interpretation:** Dr. Neelakshi Mahanta, Dr. Hitesh Deka, Dr. Naba K. Kalita. **Manuscript writing and final approval of manuscript:** All authors. **Accountable for all aspects of the work:** All authors.

## REFERENCES

1. Bray F, Ferlay J, Soerjomataram I, Siegel RL, Torre LA, Jemal A. Global Cancer Statistics 2018: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. *CA Cancer J Clin* 2018 Nov;68(6):394-424.

2. Casper ES, Waltzman RJ, Schwartz GK, Sugarman A, Pfister D, Ilson D, Woodruff J, Leung D, Bertino JR. Phase II trial of Paclitaxel in patients with soft-tissue sarcoma. *Cancer Invest.* 1998;16(7):442-6.
3. Chang J. Chemotherapy dose reduction and delay in clinical practice. evaluating the risk to patient outcome in adjuvant chemotherapy for breast cancer. *Eur J Cancer.* 2000 Apr;36 Suppl 1:S11-4.
4. Smith TJ, Khatcheressian J, Lyman GH, Ozer H, Armitage JO, Balducci L, et al. 2006 update of recommendations for the use of white blood cell growth factors: an evidence-based clinical practice guideline. *J Clin Oncol.* 2006 Jul 1;24(19):3187-205.
5. Caggiano V, Weiss RV, Rickert TS, Linde-Zwirble WT. Incidence, cost, and mortality of neutropenia hospitalization associated with chemotherapy. *Cancer.* 2005 May 1;103(9):1916-24.
6. Dafni U, Grimani I, Xyrafas A, Eleftheraki AG, Fountazilas G. Fifteen-year trends in metastatic breast cancer survival in Greece. *Breast Cancer Res Treat* 2010 Feb;119(3):621-31.
7. Giordano SH, Buzdar AU, Smith TL, Kau SW, Yang Y, Hortobagyi GN. Is breast cancer survival improving? *Cancer* 2004 Jan 1;100(1):44-52.
8. Agarwal G, Ramkant P. Breast cancer care in India: The current scenario and challenges for the future Breast care (Basel) 2008;3(1):21-7.
9. National Cancer Registry Programme: First All India Report: 2001-2002, Chapter 2: Overall planning and methods. 2010. Available from: URL:<http://www.ncdirindia.org/ncrp/ca/map.aspx>.
10. National Cancer Registry Programme: First All India Report: 2001-2002, Chapter 4: Minimum incidence rates of cancer [all sites] in districts. 2010. Available from: URL:[http://www.ncdirindia.org/ncrp/ca/chapter4\\_1.aspx](http://www.ncdirindia.org/ncrp/ca/chapter4_1.aspx).
11. Gogia A, Deo SVS, Sharma D, Thulkar S, Kumar R, Malik PS, et al.: Clinicopathologic characteristics and treatment outcomes of patients with up-front metastatic breast cancer: Single-centre experience in India. *J Global Oncol* 2019 Mar;5:1-9.
12. Kunikullaya SU, Poddar J, Sharma AD, Patel S. Pattern of distant metastasis in molecular subtypes of carcinoma breast: An institutional study. *Indian j cancer* 2017;54(1): 327-32.
13. Schwenkglenks M, Jackisch C, Constenla M, Kerger JN, Paridaens R, Auerbach L, Bosly A, Pettengell R, Szucs TD, Leonard R. Neutropenic event risk and impaired chemotherapy delivery in six European audits of breast cancer treatment. *Support Care Cancer.* 2006 Sep;14(9):901-9.
14. Chia VM, Page JH, Rodriguez R, Yang SJ, Huynh J, Chao C. Chronic comorbid conditions associated with risk of febrile neutropenia in breast cancer patients treated with chemotherapy. *Breast Cancer Res Treat.* 2013 Apr;138(2):621-31.
15. Ye X, Zhai Q, Wang ZY, Du Q, Zhu B, Yu B. Neutropenic complications in Chinese patients with breast cancer in a real-world setting. *International journal of clinical and experimental pathology.* 2017 Jan 1;10(1):651-660.
16. Hashiguchi Y, Kasai M, Fukuda T, Ichimura T, Yasui T, Sumi T. Chemotherapy-induced neutropenia and febrile neutropenia in patients with gynecologic malignancy. *Anticancer Drugs.* 2015 Nov;26(10):1054-60.
17. do Nascimento TG, de Andrade M, de Oliveira RA, de Almeida AM, Gozzo Tde O. Neutropenia: occurrence and management in women with breast cancer receiving chemotherapy. *Rev Lat Am Enfermagem.* 2014 Mar-Apr;22(2):301-8.
18. Weycker D, Edelsberg J, Kartashov A, Barron R, Lyman G. Risk and healthcare costs of chemotherapy-induced neutropenic complications in women with metastatic breast cancer. *Chemotherapy.* 2012;58(1):8-18.



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RESEARCH PAPER

# Comparative study of presumptive and confirmatory tests for detection of blood on serial dilutions and washed stains

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**Background and aims:** Detection of blood from blood stains is the first crucial step for forensic analysis, such as DNA profiling. After committing the crime, the criminal tries to destroy evidence such as blood stains by washing their clothes or other circumstances found at the crime scene make the blood or blood stains diluted due to washing by water or detergent. This study aimed to identify the most sensitive presumptive test among phenolphthalein, tetramethylbenzidine (TMB), benzidine, leuco-malachite green (LMG), and luminol for the washed and serially diluted blood and bloodstains and confirmatory test of blood among Takayama, Teichmann, and Wagenaar. **Materials and methods:** In this study, serially diluted blood, stains of the serially diluted blood, and blood-stained clothes were prepared and subjected to different kinds of washings. Blood was detected using reagents of phenolphthalein, TMB, benzidine, LMG, and luminol with variable protocols reported in various literatures. The samples were further tested for the confirmatory tests of blood using Takayama, Teichmann, and Wagenaar tests. **Results:** It is observed that in presumptive testing of serially diluted bloodstains, luminol shows positive results in all (1:10 to 1:100,00,000) followed by TMB (1:10000). TMB in acetate buffer solution works better for liquid blood; however, solution of TMB in glacial acetic acid works better for stains. LMG solution with zinc has higher sensitivity as compared to a solution without zinc. **Conclusion:** Luminol is the most sensitive presumptive test for detecting blood on washed and diluted bloodstains, and sensitivity decreases with an increase in wash cycles. Among confirmatory tests, the Takayama test is more promising than Teichmann and Wagenaar test.

**Keywords:** Presumptive test of blood; confirmatory test of blood; washed bloodstains; tetramethylbenzidine; luminol; takayama.

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## INTRODUCTION

Blood is one of the most essential and common physical evidence associated with crimes. In many cases, the detection of blood is the first step for further forensic analysis, such as DNA profiling, which provides crucial evidence of individualization in most cases. In many cases, the suspected bloodstains may have been washed either with water or with detergent. In some cases, evidence found in water bodies or gets wet due to rain or accidental spill of water leads to dilution of blood. There is limited literature showing comparative analysis of the sensitivity of various presumptive and confirmatory tests of blood. This study aimed to identify the most suitable and sensitive method for serially diluted blood and washed bloodstain fabrics by comparing commonly used methods for detecting blood in forensic laboratories.

In 1991, Cox M. reported that TMB is the most sensitive test out of the phenolphthalein, TMB, o-toluidine, and Leucomalachite green test.<sup>1</sup> In 2007, Tobe et al., reported that luminol and phenolphthalein gave positive results till 1:100,000 and leucomalachite green till 1:10,000.<sup>2</sup> Rebecca Andersson, in 2017, studied the sensitivity of leucomalachite green along with other reagents and reported that it gave a positive result of blood diluted till 1:2048.<sup>3</sup>

The basic principle of presumptive tests of blood is based on oxidation-reduction or redox reaction. In the presence of a catalyst, i.e., peroxidase, e.g., hydrogen peroxide, the heme part of hemoglobin will undergo oxidation, reducing reagent and giving color or fluorescence/luminescence.<sup>4</sup> During the detection of blood, phenolphthalein test gives bright pink colour,<sup>1,5</sup> while green-blue colour appeared when testing with tetramethylbenzidine (TMB),<sup>5</sup> and benzidine.<sup>6</sup> A bright-green colour appeared with leucomalachite green,<sup>7</sup> and the luminol test gives bluish-white fluorescence.<sup>8</sup> The confirmatory test involves the formation of crystals in the presence of hemoglobin. In the takayama test, the hemoglobin converts into the haemochromogen (ferroprotoporphyrin) crystal in the presence of pyridine and glucose. In the Teichmann test, the hemoglobin is converted into the haemin crystal in halogens and glacial acetic acid.<sup>5</sup> In the Wagenaar test, acetone chlorhaemin crystals are formed in the presence of acetone and HCl.<sup>9</sup>

This study aimed to identify the most sensitive presumptive test among phenolphthalein, tetramethylbenzidine (TMB), benzidine, leuco-malachite green, and luminol for the serially diluted blood, bloodstains prepared by diluted blood and washed bloodstains; and confirmatory test among Takayama, Teichmann, and Wagenaar.

## MATERIAL AND METHODS

**Blood collection:** The blood samples were collected from the blood bank of Hamidia Hospital, Bhopal, M.P., with all ethics.

**Sample preparation of serially diluted blood and diluted**

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**blood-stained cloth:** The serial dilution of freshly collected blood was prepared in distilled water in the ratio of 1:10; 1:100; 1:1,000; 1:10,000; 1:1,00,000; 1:10,00,000 and 1:1,00,00,000. Part of all the serially diluted samples was carefully spread on the cotton fabric cloth and kept for drying for ten days.

**Sample preparation of washed bloodstains:** The fresh blood was also poured uniformly on the cotton fabric to make bloodstain and kept for drying for ten days. After the cloth dried, it was washed using various washing steps:

A1: Dip in water: Stained cloth was dipped in water for 2 hours.

B1: Rinse with water: Stained cloth was washed with water for 60 minutes.

C1: Dip in detergent water: Stained cloth was dipped in detergent water for 2 hours.

D1: Rinse with detergent water with soft cycle: Stained cloth was washed with detergent water for 10 minutes.

E1: Rinse with detergent water with moderate cycle: Stained cloth was washed with detergent water for 30 minutes.

F1: Rinse with detergent water with hard cycle: Stained cloth was washed with detergent water for 60 minutes.

Thus all the above-washed cloth fabrics were again air-dried. After that, all the above three kinds of samples, i.e., serially diluted blood samples, stained fabrics prepared by serially diluted blood samples, and washed blood-stained fabrics, were tested for the presence of blood to know the detection efficiency and sensitivity of different methods.

**Reagent preparation and test procedure:** The samples were tested for presumptive and confirmatory tests with different protocols reported earlier.

**1. Phenolphthalein Test:** The stock solution for the phenolphthalein test was prepared by adding 2g phenolphthalein and 20g potassium hydroxide in 100ml of distilled water. The mixture was refluxed with 20g of powdered zinc for two hour until the solution became colourless. The stock solution was stored in a dark bottle and refrigerated, with some zinc added to keep it in the reduced form.

**Working Solution-1 of phenolphthalein:** To prepare the working solution, 20ml of stock solution was added in 80 ml of ethanol and was stored in an amber bottle. The samples were placed on filter paper, and 2-3 drops of the working solution were added, followed by 2-3 drops of 3% hydrogen peroxide. The development of pink colour indicates a positive result.<sup>1</sup>

**Working Solution-2 of phenolphthalein:** To prepare working solution, 2ml of stock solution was added in 10ml of distilled water and 2ml of ethanol.<sup>5</sup> The samples were



placed on filter paper, and the first few drops of ethanol were added, followed by few drops of working solution and few drops of 3% of hydrogen peroxide. The development of the pink colour indicates a positive result.

**2. Benzidine Test:** It was prepared by taking 13 ml of glacial acetic acid in a beaker and heated on a water bath at 50° C for 8 to 10 minutes; 1.5 g of benzidine was added and dissolved in glacial acetic acid. The beaker was removed from the water bath, and 57 ml of double-distilled water was added.<sup>6</sup> The samples were placed on filter paper, and 2-3 drops of the working solution were added, followed by 2-3 drops of 3% of hydrogen peroxide. The development of blue colour indicates the presence of blood.

### 3. Tetramethylbenzidine Test:

**Solution-1:** Prepared by adding 0.4 g of TMB in 20 ml of acetate buffer (prepared by adding 5 g of sodium acetate in 43 ml of glacial acetic acid and 50 ml of deionized water).

**Solution-2:** Prepared by adding 2 g of TMB in 100 ml of glacial acetic acid.

For both of the above TMB solutions, the samples were kept on filter paper, and 2-3 drops of the working solution were

added, followed by 2-3 drops of 3% hydrogen peroxide. The development of green-blue colour indicates the presence of blood.

### 4. Leucomalachite green Test:

**Solution 1:** 0.25 g of leucomalachite green was added in 100 ml of glacial acetic acid and 150 ml of distilled water. Then, 5g of zinc powder was added to the solution and kept for boiling under reflux for 2-3 hours until the solution had lost its colour.<sup>7</sup>

**Solution 2:** 0.1 g of leucomalachite green was added in 66ml glacial acetic acid and 33 ml distilled water to prepare the working solution.<sup>1</sup>

For both of the above solutions, the samples were placed on filter paper, and 2-3 drops of the working solution were added, followed by 2-3 drops of 3% of hydrogen peroxide. The development of green colour indicates the presence of blood.

**5. Luminol Test:** A solution of luminol was prepared by dissolving 5.0 g of sodium carbonate in 100 ml of distilled water. 0.1 g of luminol reagent was added and was stirred until dissolved completely. The solution was transferred into a spray bottle. Before the analysis, 0.7 g of sodium perborate

**Table 1** Results of various presumptive test on serially diluted blood stains

Serial dilution	Phenolphthalein Working solution 1 <sup>(Ref.1)</sup>	Phenolphthalein Working solution 2 <sup>(Ref.5)</sup>	Benzidine <sup>(Ref.6)</sup>	TMB Solution 1 <sup>(Ref.5)</sup>	TMB Solution 2 <sup>(Ref.1)</sup>	LMG Solution 1 <sup>(Ref.7)</sup>	LMG Solution 2 <sup>(Ref.1)</sup>	Luminol <sup>(Ref.8)</sup>
Positive Control	++++ve	++++ve	++++ve	++++ve	++++ve	++++ve	+++ve	+++ve
Negative Control	- ve	- ve	- ve	- ve	-ve	- ve	-ve	-ve
A1(1:10)	+++ve	+++ve	+++ve	+++ve	++++ve	+++ve	+++ve	+++ve
A2(1:100)	++ve	++ve	++ve	++ve	+++ve	++ve	++ve	++ve
A3(1:1000)	- ve	- ve	+ve	+ve	++ve	+ve	-ve	+ve
A4 (1:10,000)	- ve	- ve	- ve	- ve	+ve	- ve	-ve	+ve
A5 (1:1,00,000)	- ve	- ve	- ve	- ve	-ve	- ve	-ve	+ve
A6 (1:10,00,000)	- ve	- ve	- ve	- ve	-ve	- ve	-ve	+ve
A7 (1:1,00,00,000)	- ve	- ve	- ve	- ve	-ve	- ve	-ve	+ve

**Note:** ++++ Very strong positive, +++ Strong positive, ++ Mild positive, + Weak positive, - Negative

**Table 2** Results of various presumptive tests on serially diluted blood (liquid) samples

Serial dilution	Phenolphthalein Working solution 1 <sup>(Ref.1)</sup>	Phenolphthalein Working solution 2 <sup>(Ref.5)</sup>	Benzidine <sup>(Ref.6)</sup>	TMB Solution 1 <sup>(Ref.5)</sup>	TMB Solution 2 <sup>(Ref.1)</sup>	LMG Solution 1 <sup>(Ref.7)</sup>	LMG Solution 2 <sup>(Ref.1)</sup>	Luminol <sup>(Ref.8)</sup>
Positive Control	++++ve	+++ve	++++ve	+++++ve	+++++ve	++++ve	+++ve	+++ve
Negative Control	-ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve
A1 (1:10)	++++ve	+++ve	++++ve	+++++ve	+++++ve	++++ve	+++ve	+++ve
A2 (1:100)	+++ve	++ve	+++ve	+++++ve	+++ve	+++ve	++ve	++ve
A3 (1:1000)	++ve	+ve	++ve	+++ve	++ve	++ve	-ve	+ve
A4 (1:10,000)	-ve	-ve	+ve	+ve	-ve	-ve	-ve	-ve
A5 (1:1,00,000)	-ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve

**Note:** ++++ Very strong positive, +++ Strong positive, ++ Mild positive, + Weak positive, - Negative

**Table 3** Results of various presumptive test on washed blood stain

Serial dilution	Phenolphthalein Working solution 1 <sup>(Ref.1)</sup>	Phenolphthalein Working solution 2 <sup>(Ref.5)</sup>	Benzidine <sup>(Ref.6)</sup>	TMB Solution 1 <sup>(Ref.5)</sup>	TMB Solution 2 <sup>(Ref.1)</sup>	LMG Solution 1 <sup>(Ref.7)</sup>	LMG Solution 2 <sup>(Ref.1)</sup>	Luminol <sup>(Ref.8)</sup>
Positive Control	++ve	+++ve	++++ve	+++++ve	+++++ve	+++ve	+++ve	+++ve
Negative Control	-ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve
A1 (Dip in water)	++ve	++ve	+++ve	+++ve	+++++ve	+++ve	++ve	+++ve
B1 (Rinse with water)	+ve	+ve	+++ve	+++ve	+++++ve	++ve	++ve	+++ve
C1 (Dip in detergent water)	-ve	+ve	++ve	++ve	++ve	+ve	+ve	+++ve
D1 (Rinse with detergent water with soft cycle)	-ve	+ve	++ve	++ve	++ve	+ve	+ve	+++ve
E1 (Rinse with detergent water with moderate cycle)	-ve	+ve	++ve	++ve	++ve	+ve	+ve	+++ve
F1 (Rinse with detergent water with hard cycle)	-ve	++ve	++ve	++ve	++ve	+ve	+ve	+++ve

**Note:** ++++ Very strong positive, +++ Strong positive, ++ Mild positive, + Weak positive, - Negative

**Table 4** Results of various confirmatory test on serially diluted blood stains

Serial dilution	Takayama Test	Teichmann Test	Wagenaar Test
<b>Positive Control</b>	++++ve	++++ve	+++ve
<b>Negative Control</b>	- ve	- ve	- ve
<b>A1(1:10)</b>	+++ve	+++ve	+ ve
<b>A2(1:100)</b>	++ve	++ve	- ve
<b>A3(1:1000)</b>	+ ve	+ ve	- ve
<b>A4(1:10,000)</b>	- ve	- ve	- ve

**Note:** ++++ Very strong positive, +++ Strong positive, ++ Mild positive, + Weak positive, - Negative

**Table 5** Results of various confirmatory test on washed bloodstains

Washing level	Takayama Test	Teichmann Test	Wagenaar Test
<b>Positive Control</b>	++++ve	++++ve	+++ve
<b>Negative Control</b>	- ve	- ve	- ve
<b>A1 (Dip in water)</b>	+++ve	++ve	+ ve
<b>B1 (Rinse with water)</b>	++ve	+ve	- ve
<b>C1 (Dip in detergent water)</b>	+ ve	- ve	- ve
<b>D1 (Rinse with detergent water with soft cycle)</b>	- ve	- ve	- ve
<b>E1 (Rinse with detergent water with moderate cycle)</b>	- ve	- ve	- ve
<b>F1 (Rinse with detergent water with hard cycle)</b>	- ve	- ve	- ve

**Note:** ++++ Very strong positive, +++ Strong positive, ++ Mild positive, + Weak positive, - Negative

## DISCUSSION

Presumptive tests are usually sensitive but not specific as it reacts with the haemoglobin of all blood (human and animal) to catalyze the oxidation of a chromogenic compound, which produces a color change.<sup>10</sup> The degree of presence of haemoglobin increases the rate of positive results. A positive reaction will result in identifying the sample as possible blood but not necessarily human blood. Confirmatory tests should always follow presumptive positive tests. Various presumptive and confirmatory tests with different compositions are in use to detect blood on crime scene exhibits. In this study, a

comparative analysis of various tests was performed to determine the most effective tests for particular conditions, i.e., serially diluted blood, stains prepared from serially diluted blood, and washed bloodstains.

For serially diluted blood stains, the luminol test is the most effective as showed results in all serially diluted samples (1:10 to 1:1,00,00,000), followed by 3,3,5,5-tetramethylbenzidine (solution made in glacial acetic acid), which showed positive result till 1:10,000 (**Table 1**). When serially diluted blood (liquid) was tested for the presence of blood by various presumptive tests, it was observed that benzidine and TMB

(solution made with acetate buffer) gave results up to 1:10,000. In contrast, others gave positive results up to 1:100 or 1:1,000 (**Table 2**). We could infer from the above results that TMB composition with glacial acetic acid is effective on cloth stain, while composition with acetic buffer is more effective on liquid blood. It could also be inferred that the sensitivity of benzidine and TMB with acetate buffer solution is the same. The two working solutions of the phenolphthalein test did not differ in results, although it gives better results with liquid blood (1:1000) compared to stains (1:100). LMG solution with zinc is more sensitive than a solution without zinc, as the former gave results up to 1:1,000 and later up to 1:100 in both serially diluted blood and bloodstains (**Table 2**). The presumptive test of serially diluted bloodstain samples showed positive results up to 1:10,000, involving all the presumptive tests performed. When confirmatory (microcrystal) tests were performed, Takayama and Teichmann showed similar results up to 1:100, while the Wagenaar test showed results up to 1:10 (**Table 4**).

The washed bloodstain samples showed a positive result for all the presumptive tests except for samples washed with detergent and tested with phenolphthalein test with the composition of 20:80 of stock solution and ethanol (**Table 3**). The confirmatory test on washed blood-stained fabrics showed that the Takayama test showed results for blood-stained fabrics, washed as a dip in the water, rinse in water, and washed with detergent. Teichmann test showed results for a dip as well as a rinse in water. Wagenaar test showed the result in a dip in water only (**Table 5**). Therefore for washed bloodstains on fabrics, the Takayama test is the most suitable confirmatory test. There are few previous reports available, which also showed that sensitivity of detection of blood decrease when blood-stained fabrics were washed with detergent.<sup>11, 12</sup>

## CONCLUSION

Benzidine and TMB in acetate buffer solution have similar sensitivity for blood detection. TMB in acetate buffer solution works better for liquid blood; however, solution of TMB in glacial acetic acid works better for stains. LMG solution with zinc has higher sensitivity as compared to a solution without zinc. Luminol is the most sensitive presumptive test for detecting blood on washed and diluted bloodstains, and sensitivity decreases with an increase in wash cycles. Among confirmatory tests, the Takayama test is more promising than Teichmann and Wagenaar test.

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**Conflict of interest:** None declared.

**Ethics considerations:** Blood samples were collected from the blood bank of Hamidia Hospital, and the study was conducted following the Declaration of Helsinki.

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## REFERENCES

1. Cox M. A study of the sensitivity and specificity of four presumptive tests for blood. *Journal of Forensic Sciences*, JFSCA 1991;36(5):1503-1511.
2. Shanan S Tobe, Nigel Watson, and Niamh Nic Daeid. Evaluation of six presumptive tests for blood, their specificity, sensitivity, and effect on high molecular-weight DNA. *J Forensic Sci* 2007 Jan;52(1):102-109.
3. Andersson Rebecca. An evaluation of two presumptive blood tests and three methods to visualise blood; 2017; Linköping University, Swedish; Available from: URL: <http://www.diva-portal.org/smash/record.jsf?pid=diva2%3A1131528&dsid=5818>
4. Li Richard. *Forensic Biology*. 2nd ed. New York: CRC Press; 2015.
5. *Biology Manual*, Directorate of Forensic Science, Ministry of Home Affairs, GOI. 2005.
6. Modi JP. *A textbook of medical jurisprudence and toxicology*. 6<sup>th</sup> ed. Bombay. Butterworth & Co. (India) Ltd.; 1940.
7. National Forensic Science Technology Center. DNA analyst training laboratory manual. Available from: URL: [https://static.training.nij.gov/labmanual/Linked%20Documents/Protocols/pdi\\_lab\\_pro\\_2.18.pdf](https://static.training.nij.gov/labmanual/Linked%20Documents/Protocols/pdi_lab_pro_2.18.pdf)
8. O'Hara P.; Engelson C.; St. Peter WJ. Light and molecules, secondary level use of luminol in forensic analysis. *Chem. Educ.* 2005, 82, 49. Available from: URL: <https://www.amherst.edu/system/files/media/0005/Day%25206%2520Luminol%2520Forensics.doc>
9. Identification of blood. Sourcebook in forensic serology, immunology, and biochemistry. Available from: URL: [https://www.ncjrs.gov/pdffiles1/pr/160880\\_unit\\_2.pdf](https://www.ncjrs.gov/pdffiles1/pr/160880_unit_2.pdf)
10. Kobilinsky L. Liotti TF, Oeser-Sweat J. *DNA: Forensic and legal applications*. New York: Wiley; 2004.
11. UKessays. Comparison of Washing Powders: Blood on Clothes [Internet]. November 2018; Available from: URL: <https://www.ukessays.com/essays/biology/dna-tracing-in-forensics-biology-essay.php?vref=1>.
12. Castelló A. Francés F. Verdú F. An alternative to the human hemoglobin test in investigating bloodstains treated with active oxygen: the human glycophorin A test. *Scientific World Journal*. 2011 Apr 19;11:907-16.





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### RESEARCH PAPER

# Uniform and inclusive autopsy performa in India: a cross-sectional study and recommendations thereof

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**Background and aims:** Autopsy is an exhaustive practice and has serious medical, social and legal consequences. One should be cautious in medico-legal practice, keeping in mind that the genesis of this work is doubt, litigation, review and re-examination at various stages until conclusion by the court. One of the crucial and deciding factors in an investigation process is autopsy. Leave aside the conduction of autopsy by different categories of doctors; there is enormous variation in autopsy performa of different states/regions of India. Moreover, there is no mention of dental autopsy findings in this performa. Therefore, the study proposes a uniform and inclusive postmortem examination form in India for better documentation. **Materials and methods:** After conducting the research into five stages: a collection of 30 Postmortem forms; conducting interviews and questionnaire surveys among 250 forensic doctors; framing a uniform and digitalized Postmortem form including a performa for dental profiling and foetal autopsy; reviewing the form with 24 forensic doctors and finalizing after suggestions given by the experts. **Results:** It was found that over 80% of the Forensic doctors were unsatisfied with their current Autopsy performa in different sections. Coming to their practice in dental profiling, only 15.7% had a section of dental profiling included in their primary form. In contrast, only 19.7% of them recorded the dental findings in all the cases and the majority of them, i.e., 74.8%, recorded only in unknown/unidentified cases. **Conclusion:** An attempt to draft a uniform, relevant, informative, detailed, scientific, diagrammatic and digitalized form is made. In recommended performa, all the crucial attributes of an autopsy examination have been included to assist in the proper report preparation and sound judgments and conclusions.

**Keywords:** Forensic examination; medico-legal autopsy; dental profiling; PM form.

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## INTRODUCTION

Forensic Medicine is a branch of Medicine involving the study and application of scientific and medical knowledge for the administration of law.<sup>1</sup> Forensic investigation of human remains has two motives. The first is to recover and examine the remains for criminal investigations, including establishing the cause and manner of death. The second is to identify the remains and return them to the family of the deceased.<sup>2</sup> One of the crucial and deciding factors in an investigation process is Autopsy or Postmortem examination. An autopsy is derived from the Greek word “Autopsia”, meaning “the act of seeing for oneself.” It involves examination and dissection of a dead body to determine the cause and time of death and help identify the person.<sup>3</sup> Section 174 and 176 of Code of Criminal Procedure (Cr.P.C.) mentions the concept of a medico-legal autopsy during investigations of a sudden, suspicious, unnatural death.<sup>4</sup> A complete autopsy involves opening all the body cavities and examining all organs of the head, neck, chest and abdomen.<sup>1,5</sup> Autopsy/Postmortem examination is an exhaustive exercise and has serious medical, social and legal repercussions. The most outstanding care should be taken to avoid injustice to anyone as its result can affect people’s life, limb, and liberty. One should be cautious in medico-legal practice that the genesis of this work is doubt, litigation, review and re-examination at various stages until conclusion by the court.<sup>6</sup>

In India, all states have different formats for medico-legal postmortem examination. Various autopsy guidelines are being followed in different ways in each state, except administrative orders for panel formation for autopsy in dowry-related and custodial deaths.<sup>7</sup> Postmortem reports are usually handwritten, but due to court requirements, electronic advancement, and clarity, computerized reports are being issued by many states like Punjab and Haryana.<sup>7</sup> Sometimes, because of the absence of specific essential columns in the postmortem form, even unnecessary complications have arisen, leading to allegations of manipulations.<sup>8</sup> There are more than 500 medical colleges in India, and their training standards are different from college to college. These varied standards have created a massive

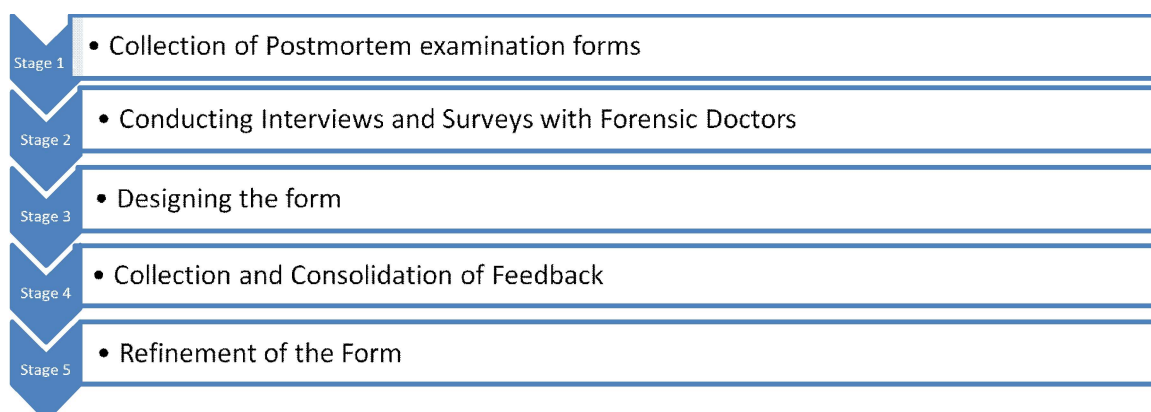
gap in forensic knowledge and practice since its MBBS doctor is responsible for conducting the autopsy most of the time. The reasons are conflicting resource material, teaching methodology, improper training of faculty, insufficient subject coverage, the pattern of assessment of trainees, inadequate human resources, poorly equipped working stations and lack of infrastructure, to name a few. At times, many criminals are let off due to improper reporting of findings and flawed workout of cases at their first contact, i.e., crime scene, in the hospitals and autopsy centres.<sup>7,9,10</sup>

Coming to the scenario of Dental autopsy, some data and awareness studies have been conducted to stress the importance of odontology in postmortem examination. There aren’t any studies in the literature that involved fieldwork in checking a dental profiling format among medical colleges and other postmortem centres performing autopsies.<sup>11</sup> To see if such an idea would add reality, a study was planned. The forensic doctors were asked to evaluate the potency of a recently developed dental profiling format with guidelines to assist them in examining and coming back to a conclusion supporting the findings.

After gathering data regarding the issues found within the autopsy in India, an attempt has been made to formulate a uniform, relevant, informative, detailed, scientific, diagrammatic and digitalized performa with the information obtained from the primary data we collected through interviews and surveys and secondary data from the literature within which all the crucial attributes of examination are present to assist in the proper report preparation and therefore adequate conclusions. This paper aimed to propose a uniform and inclusive Postmortem Examination Form in India.

## MATERIAL AND METHODS

30 Postmortem forms of various medical colleges across India at each level-central, state and district were collected (**Flow-Chart 1**). The collection mode was two ways-personally visiting the college and obtaining via emails (Collection was made after getting permission from the authorized medical in charge of the particular college). In Stage 2, a semi-structured



**Flow-chart 1** The stages of the study

interview consisting of open-ended questions was conducted through face-to-face sessions and telephonic conversations where audio recordings were done through mobile phones after obtaining informed consent from 50 forensic doctors of all grades across different countries. In the next step of Stage 2, a cross-sectional study was conducted. A close-ended questionnaire was circulated among 200 forensic doctors all over the country after taking written consent. The section included 15 questions to understand doctors' practice, experience, and opinion about their current autopsy form. The results were tabulated and analyzed separately in a Microsoft Excel spreadsheet and interpreted on a pie chart.

Collective data analysis and understanding of the postmortem forms, interviews, questionnaires and guidelines of various institutes, literature, academic knowledge, and approaches from standardized books were considered, and a postmortem form was framed. The form was divided into sections: Brief description, General observation, External examination, External injury, Dental Autopsy findings, Internal Examination, Specimen collection, opinion, and body sketches.

**Table 1** Number of Postmortem forms and Feedbacks collected.

ZONES	NO. OF FORMS COLLECTED	NO. OF FEEDBACKS OBTAINED
East	6	4
West	6	4
North	7	6
South	7	6
Central	4	4
Total	30	24

The newly designed Autopsy form was further circulated to 24 Forensic doctors all over India to obtain feedback on it (written consent was taken) (**Table 1**). The feedback performance had provisions for writing or typing comments separately for each section of the Autopsy form. The feedbacks received were critically analyzed and evaluated. If a comment seemed repetitive, a summative idea of suggestions was noted down. If feedback was found helpful, significant, or critical, they were too included in the final consolidated feedback. Further, a refined Autopsy form was developed keeping in mind the tight feedbacks which was more technical, practical and accurate.

## RESULTS

Based on the collection of PM forms from all over the country,

it was broadly interpreted that 60% of the total forms were digitalized, and the rest were handwritten. Surprisingly, only 10% had a section documenting dental features in it.

In the interview session, it was noted that 80% of the Forensic doctors would prefer a digital format to prevent discrepancy, having more transparency and for better record management. More than 50% of the forensic doctors felt that they lacked space to write all the findings. The form should be more detailed and elaborate, with more sub-headings, especially in the Internal Examination section. Moreover, 45% suggested the presence of body sketches to describe any peculiar finding which would make their work easier, whereas 40% felt that their form lacked a well-defined column for documenting Postmortem changes/time since death and a separate column to describe AM/PM injuries in which each injury should be described separately in detail with a detailed description of it. Around 30% preferred the form should include dental profiling and favouring proper hospital detail column and specimen collection information with appropriate histopathological examination. A separate form for foetal autopsy was suggested.

## SURVEY THROUGH ELECTRONIC MEDIA

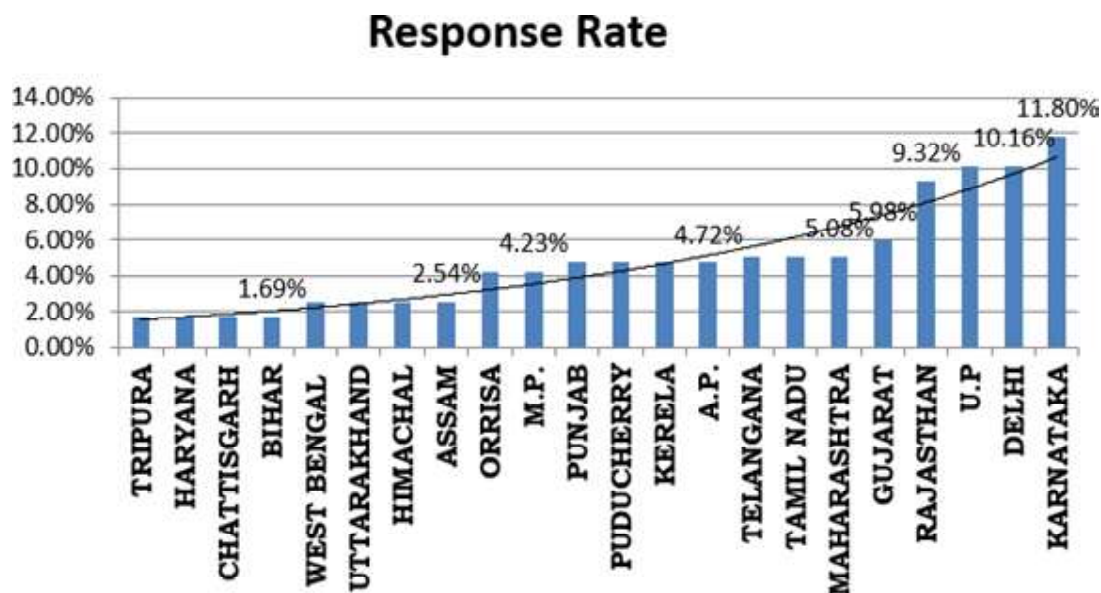
**Table 2** Participants according to Gender, Type of Institution and Work Experience of the Forensic doctors.

GENDER	
Female	8.50%
Male	91.50%
TYPE OF INSTITUTION	
Central Govt.	18.30
State Govt.	50.80%
Deemed	11.70%
Private	19.20%
WORK EXPERIENCE	
>20 Years	11.70%
16-20 Years	16.70%
10-15 Years	11.70%
5-10 Years	24.20%
<5 Years	35.80%

Out of 200 forensic doctors who participated in the study, a slight majority were males (**Table 2**). The majority of the respondents were from the state government, followed by the central government, private medical colleges and least from deemed universities (**Table 2**). Coming to the work experience, 12.6% of doctors had the experience of more

than 20 years, 28.3% were experienced between 10-20 years, and the rest had the experience of fewer than ten years (**Table 2**). Moreover, maximum participation was

seen from the state of Karnataka and least from the states of Tripura, Haryana, Chhattisgarh and Bihar, respectively (**Figure 1**).

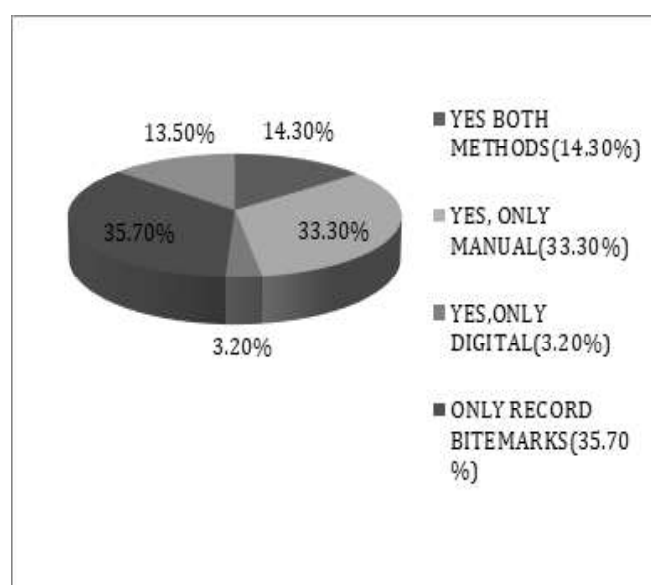


**Figure 1** Illustrates the frequency of state-wise distribution of responses

In the questionnaire section, when asked about the format of the Postmortem form used in their institute and their practice, 30.7% answered that they have been using their current form for more than 20 years. In contrast, only 26.8% of institutes have updated their form in 5 years. Nearly 78% of the forms were government adopted while their institute prepared the rest. Only 37.8% of institutes had a separate form for Foetal Autopsy, whereas others did not have. When asked about the improvements made and their preferred type of Autopsy form, 69.3% preferred a digitalized one; 73% chose an elaborate form over a concise one, whereas 62.2% preferred a personal form. Moreover, 87.4% agreed that there is a need for body sketches/pictorial representation to describe injuries or any peculiar characteristic for better understanding in some instances.

Coming to their practice in dental profiling, only 15.7% had a section of dental profiling included in their primary form. In contrast, only 19.7% of them recorded the dental findings in all the cases and the majority of them, i.e. 74.8%, recorded only in unknown/unidentified cases. When asked about recording and analyzing Bitemarks, only 35.7% recorded them, 14.3% analyzed them using manual and digital methods, 33% used manual processes, only 3.2% used digital techniques to record. In contrast, the rest, 13.5%, did not record them at all (**Figure 2**). Moreover, 67.7% of doctors practised dental age estimation methods for estimating the age of an unidentified/unknown body in which most of them relied on the eruption status (30%)

and Gustafson's method (21.25%), some of them referred to Demirjian's method (6.25%) while the remaining consulted an Odontologist (2.5%) (**Figure 3**). In dental radiography/photography practice, nearly 59.8% have never used it, whereas 18.1% have used both methods, and 11% have used at least one of them. In almost 95.5%

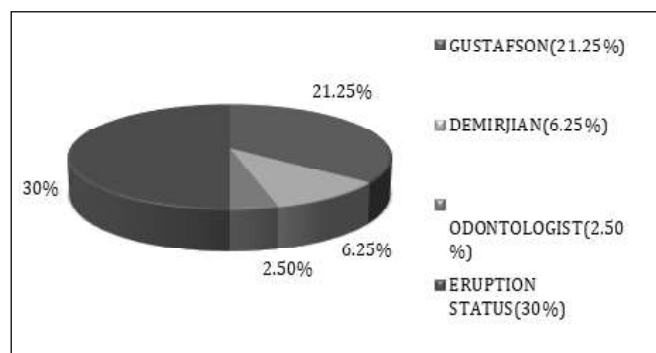


**Figure 2** Illustrates the frequency distribution of practice of recording and analyzing Bite mark cases

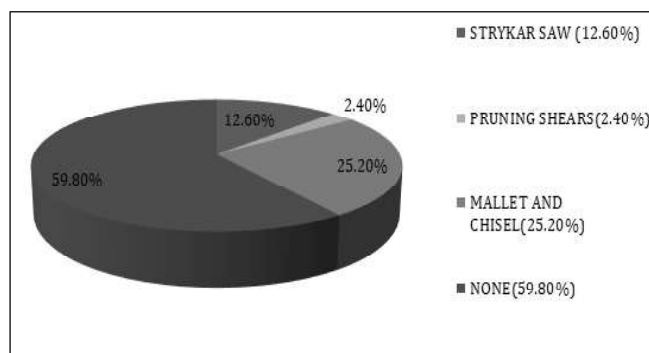


of the cases, doctors have checked for intraoral injuries (gingival, mucosal, palatal) in some instances, whereas 59.8% had not performed it in the practice of verbal autopsy. In contrast, others had performed using Pruning shears (2.4%), Stryker Autopsy saw (12.6%), Mallet and Chisel (25.3%) methods, respectively (**Figure 4**). Coming

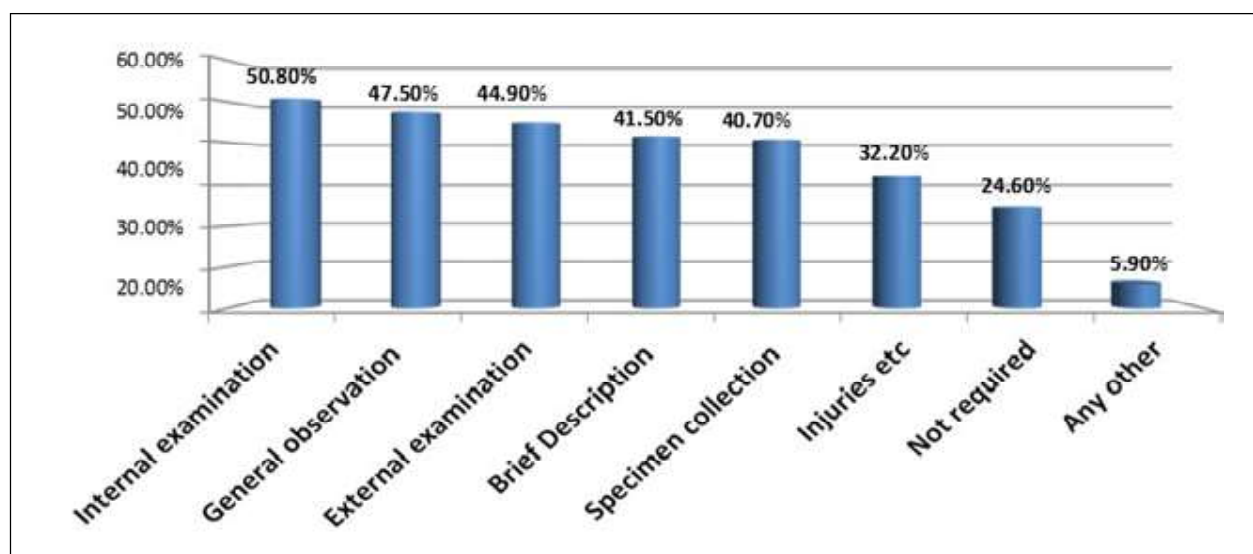
to the more significant and the most critical question of whether they are satisfied with their current Autopsy form, more than 81.40% of them responded that they are not completely satisfied and there is a scope for improvement and betterment form about various sections (**Figure 5**).



**Figure 3** Frequency distribution of age estimation methods practised in a deceased



**Figure 4** Frequency distribution of practice of performing Oral Autopsy and the type of method used.



**Figure 5** Illustration of the need for improvement about different sections of a PM form

After a cumulative analysis of the PM forms, interviews, and surveys, a draft Postmortem Examination Form was framed descriptively and elaborately, including Dental Profiling and Foetal Autopsy as annexure to it. After its completion, feedback was collected where a review regarding the performance was taken from the doctors, and other compilation and consolidation were done. A refined performance that was more accurate, better structured, had a more practical approach, and apt scientific terms were signed. Final compiled proforma of PM Form, Dental Profiling and Foetal Autopsy are attached as annexures.

## DISCUSSION

According to previous studies by Jan Valentini et al. conducted on postgraduate trainees in Germany, 66% perceived their knowledge regarding the procedure of the external postmortem examination to be inadequate or mediocre, and only 3% felt 'adequately' confident to determine the cause of death.<sup>9</sup> In another study by Andrew R Bamber et al. in the UK suggested the decline in the use of autopsy for teaching is at least in part, a consequence of the decreasing autopsy rate in the UK and elsewhere, and of a lack of clarity over which cases are

appropriate for medical student teaching in the UK.<sup>10</sup> Another study by Sai Wai Yan Myint Thu et al. in Myanmar generalized positive perceptions among decision-makers towards electronic dental records, and 86% of dentists indicated that they were willing to use them. Financial concerns were identified as the most critical barrier to implementing electronic dental records among dentists who were not ready to use the proposed system. For the long term, they recommended providing education and training in health informatics to healthcare professionals to facilitate the efficient use of electronic dental record.<sup>11</sup>

Our study's main objective was to incorporate uniformity, the notion of "One Nation One Proforma", and the three vital D's-Digitalization, Detailing and Dental profiling in it. Talking about digitalization, the practice of record maintenance after the examination procedure has become digitally available for the past few years. This keeps the records well stored in the software that are available. Though such systems offer many benefits, some institutes still prefer the conventional method of paper-based examination form. The form prepared supports paper-based examination as well.

About the structure of the format, the form was framed with the intention of not failing to include even the slightest meaningful information that could be used as a resourceful forensic aid. It was prepared after gaining sufficient knowledge from the doctors through interviews, questionnaires and literature. The formulated form was then forwarded to experienced forensic doctors all over India as they would offer an ideal source of genuine and well-grounded feedback. The feedback played a pivotal role in qualifying the efficiency of the format as it decided the fate and direction of the framework and its possible role as a potential universal format.

Moving on to the comments, the doctors appreciated the overall layout of the format and an organized way of representing data in the form of tables. They enjoyed the idea of including Postmortem changes in detail, tabulating external injuries, clothes, specimen collection in separate rows and columns and mentioning every relevant organ in the internal examination. There were some recommendations/suggestions by them which have been incorporated. As suggested by most doctors, a section for foetal autopsy has been included as they felt it plays a crucial role, but as an annexure and not in the main form.

The study has also established that postmortem dental examination is not considered a vital component in India, despite its inevitable role in medico-legal interests. But still, we took a big step of incorporating dental analysis in the format, which got mixed responses. The doctors were not routinely examining the oral cavity as per the cumulative results of the interviews and survey. Still, some of them liked the idea of incorporating coding of the teeth in dental charting, giving it a more straightforward and less time-consuming examination procedure. Coming to the Bite marks, they

considered it crucial in assault cases and applauded the vision to incorporate it in detail with each relevant finding and advised proper training before examining it.<sup>12</sup> Most of them were sceptical about incorporating dental profiling in the main form. They suggested keeping it as an annexure, using it whenever required, especially in unknown and unidentified bodies, alleged assaults and sexual assaults, especially where bite marks are present.

## CONCLUSION

One must always remember that it is on the basis of proper documentation of the postmortem examination, forensic expert gives evidence in the court of law and stands the rigors of cross-examination, as the law says that whatever is not documented has not been done. The observations are also essential for the issue of medico-legal certificates. In this study, we have attempted to frame/structure a Postmortem Examination format that can be universally accepted, keeping in mind the practice, opinions and recommendations of forensic doctors throughout the country. As we know, in the court proceedings, there are high chances to dissect a case; hence each section of the form has to be formulated in detail considering that all the relevant findings are documented, safeguarding the doctor.

Though the study has its limited merits, it can be further enhanced by increasing the sample size shortly for more precision and accuracy of results and a more extended period for covering more autopsy setups. As India is a developing country, there is a lack of resources and infrastructure, thus limiting the practicality of the format, hampering the radiological examination, digitalization of the form and autopsy techniques.

On the flipside, this research leaves many avenues for those interested in carrying this idea forward, with more forensic doctors, a longer time frame, and more locations. Framing a universal form for Age estimation, the skeletal examination would also contribute to attaining uniformity and filling the cavities between judiciary and Medicine. The root cause of inconsistency in the format is the disparity of the guidelines followed across the country and the training. Therefore, the amendment of uniform guidelines will eliminate the root cause of the difference in the formats. Moreover, software-based computers to store the documented form will solve discrepancies, enabling quick access and making it more coordinated. It preserves the privacy and security of the data even after years which are the fundamental requirement in a medico-legal case about the court of law as space storage counts.

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**Ethical corrections:** All data of the cases were treated with confidentiality, following the declaration of Helsinki.

## REFERENCES

1. Mahanta Putul. Modern textbook of forensic medicine & toxicology. 1<sup>st</sup> ed. New Delhi: Jaypee Brothers Medical Publishers; 2014. p. 3.
2. The Missing: Action to resolve the problem of people unaccounted for as a result of armed conflict or internal violence and to assist their families. ICRC Workshop on Human remains: Management of remains and of information on the dead, 10.07.2002-12.07.2002, Final report and outcome; held at Geneva. Available at [www.icrc.org](http://www.icrc.org) accessed on 21 August 2020.
3. Vij K. Textbook of Forensic Medicine and Toxicology. 3<sup>rd</sup> ed. New Delhi: Elsevier; 2005. p.85.
4. The Code of Criminal Procedure, 1973. Bare Act with short notes. Universal Publishing Company, New Delhi.2020: 109-11.
5. Dogra TD, Rudra A. Lyon's Medical Jurisprudence and Toxicology. Paras Medical Publishers; 1998. 11<sup>th</sup> ed. Delhi. p.69-80.
6. Bhullar DS, Gorea RK, Aggarwal AD. Medico-legal autopsy by panel of doctors-present scenario. JIAFM 2004;26(3):113-6.
7. Murty OP, Kohli AI, Millo T, Rani Mukta, Verma SK, Sikary AK, et al. Uniform Guidelines for Postmortem Work in India: Faculty Development Workshop. J For Med Tox 2013;30(1):1-150.
8. Sushant Singh Rajput's Last Meal, Time of Death Also Missing From Post-Mortem Report? Timesofindia.com, 27August 2020 assessed on 18 September 2020.
9. Valentini J, Goetz K, Yen K, Szecsenyi J, Dettling A, Joos S, et al. Knowledge, competencies and attitudes regarding external postmortem physical examination: A survey among German post-graduate trainees in general practice. European J of general practice 2018;24(1):26-31.
10. Bamber AR, Quince TA. The value of postmortem experience in undergraduate medical education: current perspectives. Advances in medical education and practice. 2015;6:159-70.
11. Wai Thu, Sai, Kijisanayotin, Boonchai, Kaewkungwal, Jaranit et al. Wirichada.Satisfaction with Paper-Based Dental Records and Perception of Electronic Dental Records among Dental Professionals in Myanmar. Healthcare Informatics Research 2017;23:304.
12. Guidelines for bite mark analysis. American Board of Forensic Odontology. Inc J Am Dent Asso 1986;112(3):383-6.



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### RESEARCH PAPER

# Comparison of the traditional lecture system with the modern presentation: as a preferred teaching technique for medical students

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**Background and aims:** The newer skills added today altering the methods of educating the health teaching. It has changed in the last few years from the old old-style technique of Chalkboard and talk (CNT) to a newer PowerPoint presentation (PPT) to the video classrooms converting the whole traditional environment of the classrooms. This paper aims to assess the perception of medical students about these two instructional methods.

**Materials and methods:** In this study cross-sectional descriptive survey was used. Medical students were selected through non-probability convenient sampling. The data were collected using a questionnaire-based survey about their views and perception of two lecture delivery methods, viz., PPT presentation, and using a chalkboard. For each of the two methods, the students were asked to rank twelve comments on a four-point scale: strongly agree, agree, disagree, or strongly disagree. The data was analyzed using SPSS version 16, and the results expressed as proportions. **Results:** In our study, more than 97% of our study respondents emphasized the value of chalk and talk and declared it a more effective and valuable teaching tool in their learning experience than PowerPoint (86%) and recommended it for teaching. **Conclusion:** Both CNT and PPT are effective methods for medical education, and both can be used to deliver classroom sessions effectively.

**Keywords:** Teaching methods; medical education; student's perspective.

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## INTRODUCTION

Lectures have been the most common form of teaching and learning since ancient times.<sup>1</sup> Although discussion methods in small groups appears to be a superior method of attaining higher-level intellectual understanding.<sup>2</sup>

During the past few decades, the classrooms' presentation

methods have changed from the traditional CNT to the modern technique of PPT. The most accepted criterion for measuring good teaching technique, however, is the amount of student learning.

Students often have little expertise in knowing if the technique selected by an individual instructor was the best teaching technique or just 'a technique' or simply the method with



which the teacher was most comfortable.<sup>3</sup>

During a lecture, both the visual and auditory senses are used to absorb information and here, assistance in the form of the visual aid is helpful.<sup>4</sup> A chalkboard is uniquely effective as a medium of classroom instruction. It has been used commonly in lectures, while transparencies with an overhead projector (TOHP) are also famous.<sup>5</sup>

In traditional classrooms, a teacher's essential instructional tools for displaying information are chalkboards, multipurpose boards, peg-boards, bulletin boards, and flip charts.<sup>6</sup> To project instructional materials, overhead transparencies displayed via an overhead projector are still commonly used classroom presentation methods.<sup>3</sup> Recently, electronic presentations have become common, and PPT is now the most popular instructional aid.<sup>7</sup>

The impact of technology has led to the increased use of computers for presenting information in many of today's classrooms. PPT hailed as an easy-to-use means of creating professional presentations for teachers for creating classroom presentations.<sup>8</sup> A study found PPT to be one of the most widely used software programs in both an area educator preparation program and local public schools.<sup>9</sup> It is seen that "more than 400 million copies of the program are currently

in circulation, and somewhere between 20 and 30 million PPT-based presentations are given around the globe each day".<sup>10</sup>

Various studies have been conducted to assess the effectiveness of lectures using PPT or other media compared to lectures using the Chalkboard or TOHP. According to one study, traditional classes with blackboard presentation were the most favoured by students from biomedicine and medicine courses.<sup>11</sup>

Recently, electronic presentations have become common, and PPT is now the most popular package used out of all electronic representations.<sup>12</sup>

Therefore, the present study was aimed to assess the student's perceptions of the impact of PPT presentations in lectures compared with the traditional CNT.

### MATERIAL AND METHODS

This is a cross-sectional descriptive study. Medical students were selected through non-probability convenient sampling. The data were collected during 2017 from the undergraduate medical students at Gauhati Medical College and hospital using a questionnaire-based survey about their views and perception of two lecture delivery methods, viz., PPT presentation, and

**Table 1** Perception of UG medical students regarding the method of chalk and talk

Sl No	Statements regarding perception	Strongly Agree	Agree	Disagree	Strongly disagree
		%	%	%	%
1.	I understand the lecture better when the teacher uses this technique	26	71	2	1
2.	I feel the student interaction is better with the teacher	33	53	12	2
3.	Eye contact between teacher and student is less	14	41	36	9
4.	The lecture advances the understanding	20	67	12	1
5.	This technique helps me to concentrate and remember better	38	50	10	2
6.	The quality and quantity of my lecture notes can't be maintained	12	48	30	10
7.	The delivery of the lecture is interesting	26	51	20	3
8.	The content of the lecture informative	19	68	11	2
9.	The lecture is audible	28	65	7	0
10.	The lecture content was well organized	30	47	20	3
11.	The teacher remains more professional	25	59	15	1
12.	The teacher needs more preparation for the class	30	50	18	2

using a chalkboard. For each of the two methods, the students were asked to rank twelve comments on a four-point scale: strongly agree, agree, disagree, or strongly disagree. The data was analyzed using SPSS version 16, and the results expressed as proportions. This study is on classroom technique and has not revealed any of the participants' identity, so ethical clearance from the ethics committee is not required. However, informed consent was taken before the collection of the data.

## RESULTS

The distribution of perception of undergraduate medical students regarding the method of the CNT is narrated in **Table 1**.

The distribution of perception among the undergraduate medical student regarding PPT as a method of teaching is narrated in **Table 2**.

**Table 2** Perception of undergraduate medical students regarding PPT

Sl No	Statements regarding perception	Strongly Agree	Agree	Disagree	Strongly disagree
		%	%	%	%
1.	I understand the lecture better when the teacher uses this technique	30	56	12	2
2.	I feel the student interaction is better with the teacher	29	45	24	2
3.	Eye contact between teacher and student is less	14	47	34	5
4.	The lecture advances the understanding	19	65	16	0
5.	This technique helps me to concentrate and remember better	30	46	21	3
6.	The quality and quantity of my lecture notes can't be maintained	12	48	37	3
7.	The delivery of the lecture is interesting	20	58	22	0
8.	The content of the lecture informative	20	71	7	2
9.	The lecture is audible	24	64	12	0
10.	The lecture content was well organized	35	50	10	5
11.	The teacher remains more professional	27	52	20	1
12.	The teacher needs more preparation for the class	31	42	23	4

In the present study, 97% of the participants emphasized the value of chalk and talk and declared it a more effective and valuable teaching tool in their learning experience than PowerPoint (86%) and recommended it for teaching.

## DISCUSSION

Teaching is an art. This study highlights that the favourites technique of lecture delivery for students by different faculties in the classroom can vary so much within the same college.

Different technologies are available in classrooms for teaching in the present-day scenario. The use of better teaching technique aid allows students to understand better. This also allows more time for interaction and further understanding. The use of technology can be a very beneficial and time-

saving tool for all teachers.

An evaluation by the students can provide the teacher with the best user feedback regarding the best teaching method.

In the present study, medical student's favoured a combination of teaching aids rather than single teaching support. Regarding medical students' preference, the order of priority of combined teaching aids they have opted for was PPT+CNT using blackboard.

This preference may probably be because the inherent deficiency of each method is compensated by the other. While CNT using blackboard, teaching is deficient in showing the three-dimensional (3-D) diagrams, animated videos and real-time sounds. However, the same can be demonstrated using

a PPT. Furthermore, PPTs take less time to present the same information as compared to CNT using blackboard teaching. CNT teaching allows the students to take down the notes and diagrams that are difficult with PPTs as there is a tendency to deliver the lecture quickly.<sup>13</sup>

The current results agree with Chaudhary R et al.<sup>14</sup> Here, and the author revealed that most students (67.1%) favoured the combined teaching aids. With the CNT using blackboard, the student pointed the drawback: it takes time to draw a labelled diagram on the board, and during that time, the teacher's eye contact with the students gets interrupted.

In their study, SN Baxi et al.,<sup>15</sup> revealed that an equal number of students preferred CNT and multimedia-based lectures. Seth et al.,<sup>16</sup> also compared the preference for teaching aid between medical students versus dental students. The medical students have preferred PPT, whereas the dental students preferred the Chalkboard in their study.

Some participating students opined that the teaching lecture's effectiveness depends on the teacher, regardless of the teaching aid. What is fundamentally essential in university teaching is not the quality of the technology, but the quality of the teacher, as revealed in a study<sup>17</sup> agree on the current results. Besides, a good teacher knows to start at a primary point of the course, which students can understand and then lead them gradually through the new and more complex issues.<sup>18</sup>

## CONCLUSION

In conclusion, combined teaching support is considered the most satisfying teaching support because one aid's inherent deficiency is compensated by the other. If single teaching assistances are to consider, then the blackboard teaching aid is the most pleased by the undergraduate medical students. They can follow the teacher well with a deep understanding of the concept effectively.

The present study and the previous studies do not bring out the superiority of any single support system of the teaching method. It seems that with the hands of a trained teacher, any teaching technique would be suitable and effective. This highlights the need for formal training of the teachers in teaching in the classroom to develop a perfect skill to motivate students.

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## REFERENCES

1. Brown G, Atkins M. Effective teaching in higher education. London, UK: Routledge; 1988. [cited 2017 March 13]; Available from: [URL:http://www.itl.usyd.edu/supervision.org/](http://www.itl.usyd.edu/supervision.org/)
2. Cannon R. Lecturing, Kensington, NSW: Higher education research and development society of Australia; 1988. [cited 2017 March 13]; Available from: [URL:http://www.rsc.org/](http://www.rsc.org/)
3. Hithesh Mishra, Vipin Kumar, Pankaj Kumar. Comparison of different teaching methodologies in a medical college in North India. IJBAMR 2013 March;6(2):464-9.
4. Sahu DR, Supe AN. The art and science of presentation: 35-mm slides. J Post grad Med 2000;46:280-5.
5. Estes A, Ressler S, Welch R, Hanus J. Seminar on communication skills. Exceed teaching workshop 2009. [cited 2017 March 13]; Available from: [URL:http://www.asce.org/](http://www.asce.org/)
6. Yoa, J. E., Ouyang, J. R., and Wang, H. A farewell to the traditional instructional media and technologies in the new millennium. 2000, [cited 2017 March 13]; Available from: [URL:http://www.unfi.edu/](http://www.unfi.edu/)
7. Prasad S, Roy B, Smith M. The art and science of presentation: Electronic presentations. J Postgrad Med 2000;46:193-8.
8. Pedras, MJ, Horton, J. Using technology to enhance teacher preparation. Paper presented at the annual meeting of the Northwest Association of Teacher Educators 2009. [cited 2017 March 13]; 1996. Available from: [URL:http://www.apbr.edu/SRATE](http://www.apbr.edu/SRATE)
9. Ljungdahl RT. Technology integration in the teacher preparation program and public schools in samHouston center for professional development and educational partnerships at samHouston state university. Dissertation Abstracts International 61(8):3133.
10. Does PowerPoint make you stupid? [cited 2017 March 13]; Available from: [URL:http://www.sociable-media.com/PDF/](http://www.sociable-media.com/PDF/)
11. Novelli ELB, Fernandes AAH. Student's preferred

- teaching techniques for biochemistry in biomedicine and medicine courses. *Biochem Mol Biol Educ* 2007;35:263-6.
12. Prasad S, Roy B, Smith M. The art and science of presentation: electronic presentations. *J Post grad Med* 2000;46:193-8.
  13. Vikas Seth, Prerna Upadhyaya, Mushtaq Ahmad, Virendra Kumar. Impact of various lecture delivery methods in pharmacology. *EXCLI Journal* 2010;9:96-101.
  14. Chaudry R, Dullo P, Gupta U. 2009. Attitude of 1<sup>st</sup> MBBS medical students about two different visual aids in physiology lectures. *Pak Journal Physiology* 2005;5(2):94-6.
  15. SN Baxi, CJ Shah, RD Parmar, Parmar, CB Tripathi. Student's perception of different teaching aids in a medical college. *AJHPE* 2009;1(1):15-6.
  16. Vikas S, Prerna U, Mushtaq A, Vijay M. PowerPoint or chalk and talk: perceptions of medical students versus dental students in a medical college in India. *Advances in Medical Education and Practice* 2012;1:11-6.
  17. Ahmed C. PowerPoint versus traditional overheads. Which is more effective for learning? Paper presented at conference for the South Dakota Association for Health, Physical Education and Recreation; 1998.
  18. Shallcross DE, Harrison TG. Lectures: electronic presentations versus chalk and talk – a chemist's view. *Chem Educ Res Pract* 2007;8:73-9.



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### RESEARCH PAPER

# Clinical and hemodynamic assessment of patient receiving prosthetic mitral valve replacement

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**Background and aims:** Mitral valve replacement by mechanical or bioprosthetic valves revolutionized the care of patients with severe mitral valve disease. Mitral valve is commonly affected by Rheumatic heart disease, leading to the development of mitral stenosis and regurgitation requiring prosthetic replacement. The clinical and hemodynamic assessment of patients undergoing mitral valve replacement is substantial in measuring the extent of morbidity. The present study assesses patients' pre and post-operative hemodynamic parameters having mitral valvular diseases requiring prosthetic replacement. **Materials and methods:** The study included 45 selected cases of the mitral valvular lesion that underwent prosthetic replacement of mitral valve admitted in the cardiothoracic surgery department at a tertiary care centre. A detailed history of each patient was taken, and subsequent management and follow up was done. The hemodynamic assessments of the patients were performed by invasive pressure measurement and by echocardiographic measurement during preoperative, post-operative and follow-up period. Statistical analysis was performed with the Quick Calcs Online calculator (Graph Pad Software). Continuous variables are expressed as mean and standard deviation after checking for normality of distribution. Differences between baseline and follow-up were analyzed using paired t-test. A p-value of <0.05 was considered statistically significant. **Results:** A total of 45 patients of age ranging from 14 years to 65 years undergoing mitral valve replacement were included in the study. Substantial decrease in the mean pulmonary artery (PA) and left atrium (LA) pressure were observed after valve replacement compared to pre valve replacement in all the three valvular lesion groups, i.e., mitral stenosis, mitral regurgitation and combined valvular lesion groups with p-value <0.0001. The subsequent decrease in left atrial diameter post-operative six months was also noted in all the groups. No significant postoperative improvement in ejection fraction was noticed in the mitral stenosis and mitral regurgitation group. Considerable progress in mean transmitral gradient after valve replacement is seen among all the groups (p value <0.0001) with a substantial decrease at six-month post-operative compared to the preoperative trans-mitral gradient. **Conclusion:** Steady, significant improvement in patients with different valvular abnormalities is noticed after prosthetic replacement of the mitral valve. Prosthetic replacement of mitral valve provides satisfying hemodynamic improvement.

**Keyword:** Rheumatic heart disease; mitral valve; mitral stenosis; mitral regurgitation; hemodynamics; echo-cardiography.

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## INTRODUCTION

The prevalence of rheumatic heart disease varies widely by region. It is more prevalent in developing countries with 5.5-5.7 per 1,000.<sup>1</sup> Rheumatic fever is the leading cause of mitral valve disease globally, particularly in developing countries. However, a global decline in its prevalence is noticed over the years.<sup>2</sup> The mitral valve is a dual-flap valve in the heart between the left atrium (LA) and the left ventricle (LV). The mitral valve is commonly affected by Rheumatic Heart Disease (RHD), leading to mitral stenosis and regurgitation development.<sup>3</sup> The predominant cause of Mitral Stenosis (MS) characterized by narrowing the mitral valve orifice is rheumatic fever.<sup>4</sup> The mitral valve apparatus involves the mitral leaflets, chordae tendineae, papillary muscles and a mitral annulus; abnormalities of any of these structures may cause Mitral Regurgitation. MR is caused by the retrograde flow of blood from the Left Ventricle (LV) into the Left Atrium (LA) through the mitral valve.<sup>5</sup>

To improve the patient's survival and enhance his quality of life with severely diseased valves, implantation of a functional valve is necessary.<sup>6,7</sup> A perfect prosthetic replacement for every patient is not available until the late 1950s and early 1960s with the development of reliable, quality-controlled prosthetic heart valve devices that could effectively replace a diseased, non-reparable mitral valve with relative ease of implantation and assurance that the hemodynamic abnormalities from either mitral stenosis or mitral regurgitation were corrected and maintained indefinitely.<sup>8</sup>

Mitral valve disease with regurgitation and stenosis gives rise to various hemodynamic consequences. Longstanding left ventricular volume overload may compromise left ventricular function.<sup>9-11</sup> If the mitral valve disease is of rheumatic origin, left ventricular function may also be depressed due to myocardial fibrosis, secondary to myocarditis.<sup>12</sup> Pulmonary venous congestion may result in pulmonary hypertension; with time, pulmonary vascular disease may develop, compromising the return to normal pressures after mitral valve function is restored. Severe mitral valve disease often requires valve replacement, which is usually reserved for very disabled patients. Various degrees of left ventricular dysfunction and pulmonary hypertension is usually present, and the reversibility of such changes is uncertain. Hemodynamic assessment after mitral valve replacement is of use and has often been performed in adult patients.<sup>13-17</sup>

Therefore, the present study aims for the hemodynamic assessments of patients having mitral valvular diseases requiring prosthetic replacement during preoperative and postoperative periods. Echocardiography evaluation of cardiac chamber size, pressure gradient and ejection fraction was done in different valvular lesion groups and the hemodynamic assessment of patients in the perioperative period before and after valve replacement by the invasive method.

## MATERIAL AND METHODS

The study included 45 selected cases of the mitral valvular lesion that underwent prosthetic replacement of mitral valve admitted in the cardiothoracic surgery department at a tertiary care centre. A detailed history of each patient was taken, and subsequent management and follow up was done. Prosthetic replacement of mitral valve was done under total cardiopulmonary bypass with bicaval cannulation. In all cases, the mechanical prosthetic valve was used. The hemodynamic assessments of patients were done during the perioperative period by invasive pressure measurement and echocardiographic measurement during preoperative, postoperative, and follow-up periods. The values obtained were presented separately for the groups of patients with different valvular malformation.

As a part of the Hemodynamic study, direct Invasive Pressure Measurement (IPM) was taken in the Pulmonary Artery (PA) and Left Atrium (LA) before and after valve replacement along with systemic pressure in that time. In all cases, pressure measurement was done using one pressure monitoring line, one 26-gauge needle, and an invasive pressure monitor (BPL multiparameter monitor, Ultima model).

Echocardiographic examination was performed according to the ASE guidelines<sup>18</sup> using an ultrasound system (ACUSON CV 70, Siemens Healthcare, Erlangen, Germany and Hitachi EUB-5500 ultrasound scanner with TEE facility, Japan) equipped with a wideband transducer with multi-hertz imaging and tissue harmonic image capability. Standard echocardiography included parasternal long axis, parasternal short axis, apical four-chamber and subcostal views. The parameters measured explicitly during preoperative, postoperative and in the subsequent follow-up period were:

a) Left atrial diameter measured using M-mode scan of parasternal long-axis view (PLAX) and parasternal short-axis view (PSAX)

b) The percentage change in LV volume between systole and diastole called ejection fraction, which is calculated by the formula  $EF = \frac{LVEDV - LVESV}{LVEDV} \times 100\%$

The usual range of EF is 50-75%. The LV internal dimension in end-systole (LVESD) and end-diastole (LVEDD) are measured on the M-mode tracing in the parasternal long-axis view (PLAX), at the level of mitral valve leaflet tips. In Simpson's method, calculation of EF is done by using 2D echo in apical 4 chamber view to estimate LV volume in end-diastole (LVEDV) and end-systole (LVESV). This is done by tracing the LV endocardial borders of a systolic and a diastolic LV frame while the online computer software of the echo machine calculates the LV volumes. From this volume, the ejection fraction can be calculated, and

c) Mean left atrial-left ventricular gradient. The mean pressure gradient across the mitral valve is calculated using Doppler

echo in the apical 4 chamber view. When the pressure gradient is more than 10 mm of Hg, it is considered severe mitral stenosis.

After prosthetic replacement of the mitral valve, as a part of the hemodynamic assessment, all patients were followed up with echocardiography at the 1<sup>st</sup> month, 3<sup>rd</sup> months and 6<sup>th</sup> months in the postoperative period. Regular measurements of LA diameter, ejection fraction, and trans-mitral gradient were done in the follow-up period and compared with the preoperative readings in three valvular lesions.

Statistical analysis was performed with the Quick Calcs Online calculator (GraphPad Software). Continuous variables are expressed as mean and standard deviation after checking distribution normality. The paired t-test used to test significant differences between baseline and follow-up values of variables. A p-value < 0.05 was considered statistically significant. Ethical clearance was taken before the collection of the data from the institutional ethics committee.

## RESULTS

During the study period, 45 cases were selected for prosthetic replacement of the mitral valve out of 284 patients with mitral valvular diseases admitted to the Cardio-thoracic Department. The age of the patients ranged from 14-65 years. The majority of the patients (62.2%) were females. The valvular malformations were observed predominantly as mitral regurgitation (37.8%), combined valvular lesion (37.8%) and mitral stenosis (24.4%).

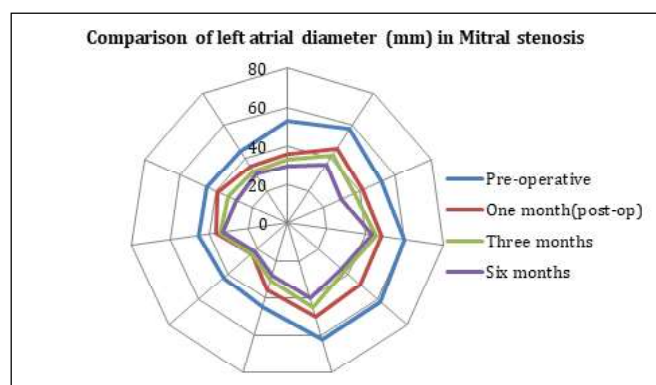
**Hemodynamic assessment using IPM in the different valvular lesion group:** Among the 11 patients with mitral stenosis, the mean PA and LA pressure was observed to be significantly reduced after valve replacement. A similar reduction in mean PA and LA pressure was also observed among those with mitral regurgitation and combined valvular lesion with a p value <0.0001 in all the above conditions (**Table 1**).

**Table 1** Invasive Pressure Measurements among different valvular lesion groups

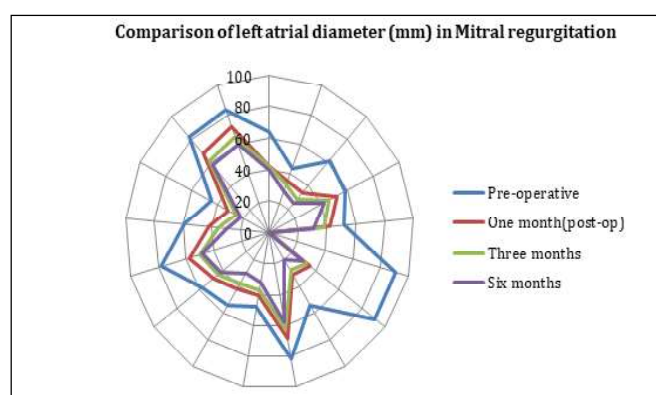
Valvular Lesion group	IPM	Before Valve replacement		After Valve replacement		p-value
		Mean	S.D.	Mean	S.D.	
Mitral Stenosis (n=11)	PA	54.18	18.26	44.36	15.57	<0.0001
	LA	31.64	5.52	19.73	2.9	<0.0001
Mitral regurgitation (n=17)	PA	33.82	11.02	28.88	10.14	<0.0001
	LA	24.35	8.5	18.24	5.77	0.0003
Combined valvular lesion (n=17)	PA	37.71	12.71	31.35	13.13	<0.0001
	LA	23.76	6.21	17.35	4.03	<0.0001

**Comparison of pre and post-operative left atrial diameter among different valvular lesion groups:** The comparison of left atrial diameter before and after valve replacement with subsequent follow-up period in predominant Mitral stenosis is shown in **Figure 1**. The mean and SD of left atrial diameter

in preoperative and post-operative after six months were found to be  $51.82 \pm 7.61$  and  $32.45 \pm 5.94$ , respectively. The difference was highly significant, with a p value less than 0.0001.



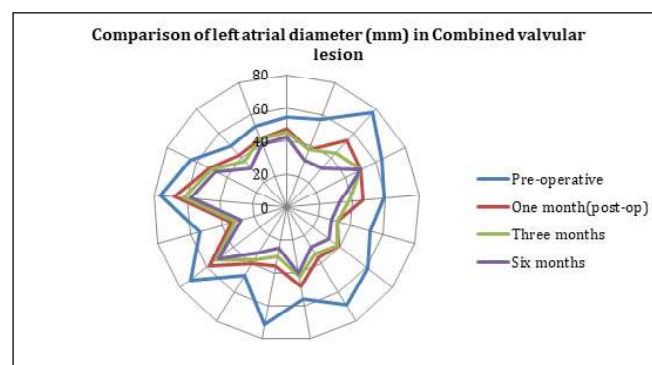
**Figure 1** Left atrial diameter in the preoperative and postoperative period in Mitral stenosis.



**Figure 2** LA diameter in the preoperative and postoperative period in mitral regurgitation

In the predominant Mitral regurgitation group, the mean( $\pm$ SD) left atrial diameter in the preoperative period was 65.12( $\pm$ 16.07) substantially reduced to 37.19( $\pm$ 13.04) post-operative after six months with p-value<0.001 (**Figure 2**).

Among patients with the combined valvular lesion, the comparison of left atrial diameter before and after valve replacement with subsequent follow-up period showed a significant decrease (p-value<0.0001) in mean ( $\pm$ SD) left atrial diameter from 61( $\pm$ 9.35) in the preoperative period to 37( $\pm$ 9.8) in the post-operative period after six months as shown in **Figure 3**.



**Figure 3** LA diameter in the preoperative and postoperative period in combined valvular lesion

**Comparison of Ejection fraction in different valvular lesion group:** The comparison of ejection fraction before and after valve replacement with subsequent follow-up period among different valvular lesion groups were presented in **Table 2**.

**Table 2** Ejection fraction among different valvular lesion groups

	Mitral Stenosis			Mitral regurgitation			Combined valvular lesion		
	Mean	S.D.		Mean	S.D.		Mean	S.D.	
Pre-operative	57.36	7.62		60.38	6.36	-	60.76	6.57	
1month post op	51.73	5.62	0.057	53.06	8.03	<0.01	56.24	7.79	0.019
3months post op	57.00	5.49	0.89	55.19	6.41	<0.01	59.88	7.74	0.64
6month post op	61.09	4.95	0.064	61.38	6.47	0.41	66.35	6.29	0.001

The mean ejection fraction in preoperative and postoperative periods was not statistically significant in the predominant mitral stenosis group. While in the case of MR, a substantial decline in mean ejection fraction was observed during the first month of post-operative compared to the preoperative mean ejection fraction. However, the mean ejection fraction gradually increased over time with a mean ejection fraction of 61.38 at 6 months follow up with no significant difference

with the mean preoperative ejection fraction of 60.38. In patients with combined valvular lesions, a significant decrease in mean ejection fraction were observed at the month of follow up after valve replacement which eventually increased in subsequent follow-ups.

#### Comparison of pre and post-operative mean trans-mitral gradient among different valvular lesion groups:

**Table 3** Mean trans-mitral gradient among different valvular lesion groups

	Mitral Stenosis			Mitral regurgitation			Combined valvular lesion		
	Mean	S.D.		Mean	S.D.		Mean	S.D.	
Pre-operative	11.27	3.04		10.75	4.88		13.29	4.65	
1month post-op	2.97	0.54	<0.001	3.20	0.62	<0.001	3.31	0.75	<0.001
3months post-op	2.64	0.48	<0.001	2.76	0.49	<0.001	2.86	0.73	<0.001
6months post-op	2.13	0.48	<0.001	2.28	0.41	<0.001	2.41	0.64	<0.001

The comparison of mean trans-mitral gradient before and after valve replacement with subsequent follow-up period in predominant Mitral stenosis group showed a significant decrease in postoperative period over time from the preoperative mean trans-mitral gradient with p-value <0.001. Similar kinds of a substantial reduction in trans-mitral gradient over time were also observed among the Mitral regurgitation group (p-value <0.001). The highest mean trans-mitral gradient at the preoperative period was observed among the combined valvular lesion group with a mean ( $\pm$ S.D.) of 13.29( $\pm$ 4.65) which significantly decreased to 2.41( $\pm$ 0.64) in six months postoperative period (**Table 3**).

## DISCUSSION

In the present study, hemodynamic assessments were done using echocardiography in all cases in the preoperative, postoperative period and in follow-up period to measure the left atrial diameter, ejection fraction and mean transmitral gradient and data were analyzed separately for different valvular lesion groups. Also, direct invasive pressure measurement was taken in PA and LA before and after valve replacement for perioperative hemodynamic assessment.

In the present study, the substantial reduction in both mean PA and mean LA pressure after valve replacement comparing to pre valve replacement were noted in all the three valvular lesion groups with a p-value <0.0001. A similar type of hemodynamic improvement was noted in various other studies.<sup>16,17,19-23</sup>

Ejection fraction is significantly improved in the combined valvular lesion group but not in mitral stenosis or mitral regurgitation group in six-month post-operative follow up in the present study. A non-significant ejection fraction in the post-operative period probably due to myocardial injury caused by a chronic volume overload, and the sequelae of rheumatic carditis is reported in another study.<sup>24</sup> In patients with mitral stenosis, moderately reduced left ventricular (LV) ejection fraction (EF) may be due to either depressed myocardial contractility or alterations in loading conditions.<sup>25</sup>

The echocardiography measurements in the present study reveal a significant reduction in mean left arterial diameter and trans-mitral gradient post-operatively in the three groups. Significant decreases in mean trans-valvular pressure gradient (MPG) over time following MVR were reported in another

study with no substantial variation among patients with or without prosthesis-patient mismatch.<sup>26</sup>

**Limitation:** The total number of patients evaluated in this study was small, and the present result represents only the early assessments within the first six months after surgery. Cath study was not done in the preoperative and postoperative period to assess the hemodynamic status, which was the major limitation of this study. In this study, changes of hemodynamics in between rest and exercise could not be measured. Also, left ventricular end-diastolic pressure was not measured due to the limitation of the cath study.

## CONCLUSION

Hemodynamic assessment was made during pre, peri and post-operative period, which shows steady improvement in patients with predominantly stenotic, predominantly regurgitant and combined valvular lesion groups after prosthetic replacement of mitral valve procedure. The results of this study are comparable to other similar published clinical observations. Prosthetic replacement of mitral valve provides gratifying hemodynamic improvement.

## REFERENCES

- Carapetis JR, Steer AC, Mulholland EK, Weber M. The global burden of group A streptococcal diseases. *Lancet Infect Dis* 2005;5(11):685-94.
- Iung B, Baron G, Butchart EG, Delahaye F, Gohlke-Bärwolf C, Levang OW, et al. A prospective survey of patients with valvular heart disease in Europe: The Euro Heart Survey on Valvular Heart Disease. *Eur Heart J* 2003;24(13):1231-43.
- Dass C, Kanmanthareddy A. Rheumatic heart disease. In: StatPearls. Treasure Island (FL): StatPearls Publishing; 2020.
- Shah SN, Sharma S. Mitral Stenosis. In: StatPearls. Treasure Island (FL): StatPearls Publishing; 2021.
- Douedi S, Douedi H. Mitral Regurgitation. In: StatPearls. Treasure Island (FL): StatPearls Publishing; 2021.
- Rahimtoola SH. Choice of prosthetic heart valve in adults an update. *J Am Coll Cardiol* 2010;55(22):2413-6.
- Arora S, Misenheimer JA, Ramaraj R. Transcatheter aortic valve replacement: Comprehensive review and present status. *Tex Heart Inst J* 2017;44(1):29-38.
- Harken DE, Taylor WJ, Lefemine AA, Lunzer S, Low HB, Cohen ML, et al. Aortic valve replacement with a caged ball valve. *Am J Cardiol* 1962;9:292-9. Doi: 10.1016/0002-9149(62)90047-4
- Jaakani JMM, Graham TP Jr, Canent RV Jr, CappMP. The effect of corrective surgery on left heart volume and mass in children with the ventricular septal defect. *Am J Cardiol* 1971;27:254-8.
- Peterson CR, Herr R, Crisera RV, Starr A, Bristow JD, Griswold HE. The failure of hemodynamic improvement after valve replacement surgery. *Ann Intern Med* 1967;66:1-24.
- Ramakrishna H, Craner RC, Devaleria PA, Cook DJ, Housmans PR, Rehfeldt KH. Valvular Heart Disease. In: Kaplan's Essentials of Cardiac Anesthesia. Elsevier; 2018. p. 352-84.
- Maganti K, Rigolin VH, Sarano ME, Bonow RO. Valvular heart disease: diagnosis and management. *Mayo Clin Proc* 2010;85(5):483-500.
- Braunwald E, Braunwald NS, Ross J Jr, Morrow AG. Effects of mitral valve replacement on the pulmonary vascular dynamics of patients with pulmonary hypertension. *N Engl J Med* 1965;273:509-14.
- Zener JC, Hancock EW, Shumway NE, Harrison DC. Regression of extreme pulmonary hypertension after mitral valve surgery. *Am J Cardiol* 1972; 30: 820-6.
- Bristow JD, Kremkau EL. Hemodynamic changes after valve replacement with Starr-Edwards prostheses. *Am J Cardiol* 1975;35:716-24.
- Bayat F, Aghdaii N, Farivar F, Bayat A, Valeshabad AK. Early hemodynamic changes after mitral valve replacement in patients with severe and mild pulmonary artery hypertension. *Ann Thorac Cardiovasc Surg* 2013;19(3):201-6.
- Tempe DK, Hasija S, Datt V, Tomar AS, Virmani S, Banerjee A, et al. Evaluation and comparison of early hemodynamic changes after elective mitral valve replacement in patients with severe and mild pulmonary arterial hypertension. *J Cardiothorac Vasc Anesth* 2009;23(3):298-305.
- Douglas PS, Khandheria B, Stainback RF, Weissman NJ, Brindis RG, Patel MR, et al. ACCF/ASE/ACEP/ASNC/SCAI/SCCT/SCMR 2007 appropriateness criteria for transthoracic and transesophageal echocardiography: A report of the American college of cardiology foundation quality strategic directions committee appropriateness criteria working group, American society of echocardiography, American college of emergency physicians, American society of nuclear cardiology, society for cardiovascular angiography and interventions, society of cardiovascular computed tomography, and the society for cardiovascular magnetic resonance endorsed by the American college of chest physicians and the society of critical care medicine. *J Am Coll Cardiol* 2007;50(2):187-204.
- Hoar PF, Mookerjee A, Stone JG, Wicks AE, Malm JR. Acute hemodynamic alterations after mitral valve

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- replacement with the glutaraldehyde-treated porcine heterograft prosthesis. *Ann Thorac Surg* 1980;29(5):434-9.
20. Song X, Zhang C, Chen X, Chen Y, Shi Q, Niu Y, et al. An excellent result of surgical treatment in patients with severe pulmonary arterial hypertension following mitral valve disease. *J Cardiothorac Surg* 2015;10(1):70.
  21. Nellessen U, Inselmann G, Ludwig J, Jahns R, Capell AJ, Eigel P. Rest and exercise hemodynamics before and after valve replacement—a combined Doppler/catheter study. *Clin Cardiol* 2000;23(1):32-8.
  22. Mubeen M, Singh AK, Agarwal SK, Pillai J, Kapoor S, Srivastava AK. Mitral valve replacement in severe pulmonary arterial hypertension. *Asian Cardiovasc Thorac Ann* 2008;16(1):37-42.
  23. Alsaddique AA. Mitral valve replacement with the Clinical and hemodynamic assessment of patient receiving prosthetic mitral valve replacement preservation of the entire valve apparatus. *Braz J Cardiovasc Surg* 2007;22(2):218-23.
  24. Benmimoun EG, Friedli B, Rutishauser W, Faidutti B. Mitral valve replacement in children. Comparative study of pre-and postoperative haemodynamics and left ventricular function. *Br Heart J*. 1982;48(2):117-24.
  25. Mangoni AA, Koelling TM, Meyer GS, Akins CW, Fifer MA. Outcome following mitral valve replacement in patients with mitral stenosis and moderately reduced left ventricular ejection fraction. *Eur J Cardiothorac Surg* 2002;22(1):90-4.
  26. Lee SH, Chang BC, Youn Y-N, Joo HC, Yoo K-J, Lee S. Impact of prosthesis-patient mismatch after mitral valve replacement in rheumatic population: Does mitral position prosthesis-patient mismatch really exist? *J Cardiothorac Surg* 2017;12(1):88.



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### RESEARCH PAPER

# Detectability of seminal stains on fabrics after various washing steps

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**Background and aims:** Biological evidence that can help in individualization by DNA profiling is considered crucial evidence in a court of law and helps in the timely delivery of justice. In sexual assault cases, the evidence having the utmost importance is detecting semen in the genital swab or on the victim's clothes. However, semen stains may be washed before seizure by investigating agencies, and some semen can remain as evidence even after washings. This study aims to find the most suitable methods for detecting semen stains after various washing steps. **Material and methods:** White cotton fabric pieces were stained uniformly with semen and air-dried for ten days. The stains were washed in two batches, i.e., with detergent and without detergent, for different time intervals. The screening, UV examination, acid phosphatase test, Florence microcrystal test, and Barberio microcrystal test were used. For the confirmation, a prostate-specific antigen (PSA) test and microscopic examination were used. **Results:** UV Examination gave positive results up to moderate wash, and acid-phosphatase gave a positive result in all washes when done with water only on the contrary with detergent, it gave result only in the soft wash. In the confirmatory test, the PSA Test showed high sensitivity showed positive results in all washings, whereas in the microscopic examination, sperms/sperm heads could be detected in all washed stains, but with detergent the presence of sperm was limited up to the soft wash only. **Conclusion:** Washings of semen-stained fabrics with detergent significantly reduced the possibility of detecting semen and sperms for almost all tests conducted, compared to fabrics washed without detergent. PSA test showed distinguishable results even after several steps of washings. Thus the test of choice for the detection of semen on washed fabrics is PSA.

**Keywords:** Semen stains; washing; acid phosphatase; microcrystal tests; PSA; microscopic examination.

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## INTRODUCTION

Sexual violence is one of the most prevalent crimes across the world for both children and adults. Prevalence is thought to be much higher than the reported and published figures. In sexual assault cases, the detection of semen is the first and crucial step for further investigation. Often the investigators get a trace amount of semen in the exhibits, which may be due to the stains on the clothes are washed out,<sup>1</sup> or due to delayed collection of vaginal swabs. First step

for detecting seminal stains on the fabrics is presumptive test, followed by confirmatory tests.<sup>1,2</sup> There are very limited studies showing the comparative performance of various tests on seminal stain after washing. This study aimed to compare and identify a suitable method for the detection of seminal stains on fabrics after various washings.

Undiluted semen has very strong photoluminescence with a broad excitation spectrum ranging from 350nm-500nm wavelengths.<sup>3</sup> When visualized under alternate light source

(ALS), due to the conjugated proteins Flavin and Choline, dried semen stains will fluoresce.<sup>3</sup> It gives Blue fluorescence on the exposure to UV light (350-500nm), which can help in its detection on fabric.<sup>4</sup> The acid-phosphatase test is one of the most commonly used presumptive tests that use alpha-naphthol phosphate and fast blue B reagents, which test for seminal acid phosphatase in the stains. Acid Phosphatase catalyzes the hydrolysis of various phosphate esters to remove phosphate and the alcoholic group from the substrate and forms an insoluble coloured precipitate with stable diazonium salts (Zinc double salts).<sup>5,6</sup> In the Florence crystal test, the extracted stain or a piece of stain mixed with Florence reagent (Potassium Iodide+Iodine+ Distilled water),<sup>7,8</sup> brown coloured needle or rod-shaped choline iodide crystals, confirms the presence of semen on the fabric.<sup>9</sup> Another useful crystal test is the Barberio crystal test, in which spermine reacts with an aqueous or alcoholic saturated picric acid solution; it forms characteristic yellow needle-shaped crystals of spermine picrate. Both spermine and choline are constituents of seminal fluid which can be detected even when a person is aspermic. Barberio test is considered more reliable than the Florence test as it shows fewer false-negative tests than the Florence test.<sup>10</sup>

Microscopic examination for the detection of sperms is considered a confirmatory test for the identification of semen. The most commonly used method for sperm staining is Christmas tree stain; some other stains also in use are aniline blue and eosin,<sup>11</sup> hematoxylin, and eosin. Being the most useful confirmatory method, it also has one demerit that sometimes a person can be aspermic or azoospermic to natural or clinical conditions, which is why other chemicals and microcrystal methods are employed. Prostate-Specific Antigen (PSA) test is another popular confirmatory test for the detection of semen. The semen from azoospermic males will still contain this antigen which is present in the seminal plasma. An essential aspect of detecting PSA involves detecting it on contaminated or scarce samples, including laundered fabrics and decomposed cadavers.<sup>1</sup> The one-step ABA card and Cancheck PSA kit are some of the commonly used commercial PSA test kits.

It is observed that sometimes, garments with semen stains are already washed before seizure by investigating agencies. The reasons behind such washings may be intentional by criminals to destroy evidence or by mistake by the victim who is not aware of the significance of such evidence. However, it is expected that some semen remains as evidence even after washings. Therefore this study was initiated to find the most suitable methods for detecting semen stains on fabrics after various washing steps.

## MATERIAL AND METHODS

### Collection of semen samples and ethics:

Semen samples were collected from the sperm bank of 'Mayo Test Tube Baby and Endoscopy Centre, Bhopal,' ethical

guidelines were followed with informed consent from the volunteers.

### Preparation of seminal stain samples:

Collected semen was uniformly spread on cotton fabric cut in square pieces. After spreading semen, cloth pieces were allowed to air-dry for about ten days in a cleanroom. A total of eight stain samples were prepared on cotton fabric. The eight samples included one positive control, one negative control, and the remaining six samples for six different types of washings. After the samples were prepared, each sample was stored separately and was denoted from samples A to F. After sampling; the washing setup was categorized as washing with water only (sample A, B & C) and washing with detergent and water (sample D, E & F). The unwashed sample was taken as a positive control, and the unstained sample was taken as a negative control. Washing was categorized into three types- soft, moderate, and hard based on the wash cycle. Based on the washing time interval, the samples were subcategorized as A1, A2, B1, B2, and so on. Washing was done by simulating the wash cycle of a machine by taking cloth pieces in 50ml tubes and mixing them in a vortex mixer in respective time intervals. After washing, the samples were air-dried and subjected to analysis with different methods of detection.

### Tests for the Detection of Seminal Stains:

**Acid Phosphatase Test:** Buffer was prepared by mixing 5ml glacial acetic acid and 10g of sodium acetate, and volume was made up to 500ml. Then 0.63g of sodium- $\alpha$ -naphthyl phosphate (0.25%) was added in 250ml buffer and 1.25g naphthyl diazo blue B(0.5%) was added to 250ml buffer and mixed thoroughly. To test the method, we took pieces of all stain samples, i.e., negative control, washed samples, and two different control samples washed at different intensities and placed on a piece of filter paper. After that, 1 or 2 drops of reagent-1, i.e., sodium- $\alpha$ -naphthyl phosphate in buffer was added and allowed to soak for few seconds; then few drops of reagent-2, i.e., naphthyl-diazo-blue-B in buffer, were added.<sup>11</sup> If the purple colour appeared within 1min, then the presence of semen is confirmed, and if the colour appears after one minute, then it is considered to be due to non-prostate acid phosphatase.<sup>8</sup>

**Barberio Test:** Extract was prepared from stains with dilute HCL, after which a drop of the extract was placed on the microscopic slide, and the saturated aqueous or alcoholic picric acid solution was added and covered with a coverslip. It was observed under a microscope for the detection of the appearance of spermine picrate crystals.<sup>12</sup>

**Florence Test:** 1.65g potassium iodide and 2.54g iodine were added in 30ml distilled water. The stains were extracted with normal distilled water or dilute HCL in 1.5ml microtubes for about 1-2 hours. Then the extract of semen stain was placed on a microscopic slide, and a drop of Florence reagent was

added, covered with a coverslip, and analyzed under a compound microscope to detect the crystals.<sup>12,13</sup>

**Microscopic Examination:** Aniline blue (1g aniline blue in 10 ml phenol (1% aq) +30 ml distilled water) and eosin yellow (1g in 100ml distilled water) was prepared and mixed to prepare the final stain. We prepared extracts of sample stains in saline (8.5g of NaCl in 1000ml distilled water) by keeping

overnight. Then these extracts were smeared on the microscopic slides, and the smears were allowed to dry. Smears were air-dried, kept in the ether: ethanol (1:1) overnight for fixation. After fixation, slides were air-dried and stained with dye and analyzed for sperm under microscope.<sup>11</sup>

**Table 1** Results of various tests for detection of semen/sperms after different washings with detergent

Sl No	Washing Time	After washing with detergent and water						
		Samples	UV light Examination	AP Test	Barberio Crystal Test	Florence Crystal Test	PSA Test	Microscopic Examination of sperms/ Sperm head
1	5mins	A1	++	+++	++++	++++	++++	+++
2	10mins	A2	++	++	++	+++	+++	++
3	15mins	B1	+	+	++	+++	+++	-
4	20mins	B2	-	-	+	++	++	-
5	25mins	C1	-	-	+	+	++	-
6	30mins	C2	-	-	+	+	+	-
7	Unwashed	Positive control	++++	++++	++++	++++	++++	++++
8	Unwashed	Negative control	-	-	-	-	-	-

**Grading:** +++++ Very strong positive, +++ Strong positive, ++ Mild positive, + Weak positive, - Negative

**Table 2** Results of various tests for detection of semen after different washings without detergent

S.No	Washing Time	After washing with water only (without detergent)						
		Samples	UV light Examination	AP Test	Barberio Crystal Test	Florence Crystal Test	PSA Test	Microscopic Examination of sperms/ Sperm head
1	5 min	D1	+++	+++	+++	+++	++++	+++
2	10 min	D2	++	+++	+++	+++	+++	++
3	15 min	E1	++	+++	++	+++	+++	++
4	20 min	E2	+	++	+	++	++	+
5	25 min	F1	-	++	+	+	++	+
6	30 min	F2	-	++	-	-	+	-
7	Unwashed	Positive control	++++	++++	++++	++++	++++	++++
8	Unwashed	Negative control	-	-	-	-	-	-

Grading: +++++ Very strong positive, +++ Strong positive, ++ Mild positive, + Weak positive, - Negative

## RESULTS

The efficiency of UV light to detect washed semen stains was observed after each wash, and the fluorescence intensity of each stain was evaluated using a relative scale and categorized as very strong positive, strong positive, mild positive, weak positive, and negative.<sup>4</sup> In samples washed with detergent for 5, 10 and 15 mins showed positive results, whereas samples washed for longer than 15 mins gave a negative result (**Table 1**). In washing without detergent, samples gave a positive result up to 20 mins (**Table 2**).

In the acid-phosphatase test, it is observed that semen could be detected even after 30 mins of washing without detergent (**Table 2**). However, semen could not be detected at 20min of washing with detergent (**Table 1**). Results of Barberio and Florence's crystal tests are also displayed in **Table 1** and **Table 2**. All the samples were also tested for the presence of PSA antigen in stain samples, which showed positive results for both types of washings in all conditions tested, as mentioned earlier. Results so microscopic examination for the detection of sperm or sperm head is also tabulated above, which showed that washing with detergent significantly reduces the chances of sperm detection in stains (**Table 1, 2**).

## DISCUSSION

In several countries across the world, after the incidence of sexual offenses, it can be kept hidden for a long time without reporting due to several reasons, and semen-stained clothes of victims can often be subjected to washings before the case is notified to the investigating agencies.<sup>14,15</sup> This study has shown the potential of all the methods which are currently being used or have been used previously for the detection of semen. However, when the methods have been used in conditions where washing of the stains has been taken as an important factor, the tests showed limitations in detecting semen. Washing of semen-stained fabrics with detergent reduced the possibility of detection of semen for almost all tests in general, i.e., AP test, PSA test, microcrystal examination, and microscopic examination. The acid phosphatase test gives more reliable and suitable results for detecting semen stains after washings compared to detection under UV light. PSA test proved to be the most robust method as it gave positive results in fabrics after all the washings with & without detergent. The findings of this work are somewhat similar to the observations in a study by Ragne Kristin Farmen et al.<sup>16</sup>

## CONCLUSION

This study highlighted the sensitivity of the detection methods of semen stains. UV Examination proved to show limitations in detection of fluorescence in both washings (with detergent and without detergent), whereas in Acid phosphatase test proved ineffective in the case of washing with detergent as it only gave results up to moderate wash. PSA showed

promising results in both types of washes. However, in microscopic examination the sperm were visible under a microscope only in washing with water, and in washing with detergent, the sperms were visible only up to soft wash. Hence this study concludes that the most effective method for detecting the seminal stains on fabrics after different washes is the PSA test. This study can contribute in choosing the appropriate method for detection of semen stains when there are chances that a very low amount of semen is present on the fabric and the stains have been washed, or the evidence seized from the crime scene is in less quantity.

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**Conflict of interest:** None declared.

**Ethics considerations:** Semen sample was collected from Mayo Test Tube Baby and Endoscopy Centre, Bhopal, with ethical considerations and consent of the semen donors. All data were treated confidentially, and the study was conducted in accordance with the Declaration of Helsinki.

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## REFERENCES

- Schlagetter T, Lynn CL. The effect of fabric type and laundering conditions on the detection of semen stains. *Int J Forens Sci* 2017 July 17;2(2):000122. Available from: [URL:https://digitalcommons.newhaven.edu/forensicscience-facpubs/27/](https://digitalcommons.newhaven.edu/forensicscience-facpubs/27/)
- Crowe G, Moss D, Elliot D. The effect of laundering on the detection of acid phosphate & spermatozoa on cotton T-shirts. *Canadian Society of Forensic Science Journal* 2000;33(1):1-5. <https://doi.org/10.1080/00085030.2000.10757498>
- Cross Michaela. Detection of secondary transfer of human spermatozoa between items of clothing during a domestic washing machine cycle using the



- Quantifiler® Trio DNA Quantification kit. Masters by coursework thesis, Murdoch University; 2017, Available from:  
URL: <https://researchrepository.murdoch.edu.au/id/eprint/39828/>
4. Virkler Kelly, Lednev K Igor. Analysis of body fluids for forensic purposes: From laboratory testing to non-destructive rapid confirmatory identification at a crime scene. *Forensic Sci Int.* 2009 Mar 27;188,1-17.
  5. Li Richard. *Forensic Biology*. 2<sup>nd</sup> ed. Boca Raton: CRC Press 2015.6. Khaldi Nadia, Miras Alain, Botti Koffi, Benali Larbi, Gromb Sophie. Evaluation of three rapid detection methods for the forensic identification of seminal fluid in rape cases. *J Forensic Sci* 2004 July; 49(4):749-53.
  7. Seiden H, Duncan GT. Presumptive screening test for seminal acid phosphatase using sodium thymolphthalein monophosphate. *J Assoc Off Anal Chem* 1983 Jan; 66(1):207-9.
  8. Chapter VIII. Spermine and Choline test. Shodhganga Inflibnet. Available from: URL: <http://shodhganga.inflibnet.ac.in>
  9. Seth Sumit. Review of Forensic Medicine. December 2009. Available from: URL: <http://doctorsumitseth.blogspot.com/>
  10. Kaye Sidney. Identification of seminal stains. *J Crim L and Criminology* 1947;38(1)79. Available from: URL: <https://scholarlycommons.law.northwestern.edu/jclc/vol38/iss1/11>
  11. *Biology and Serology Manual*, Central Forensic Science Laboratory Bhopal M.P.
  12. Sabri Imran. Seminar: Detection of semen & seminal fluid stains. Department of Forensic Medicine and Toxicology, JN Medical College, AMU, Aligarh. Available from: URL: <http://www.forensicindia.com/pgteaching/semen&seminalfluid.htm>
  13. Sharma JD. *Forensic Science and Toxicology*. DHSGU Sagar M.P, The Lawyers Home. 1988.
  14. Noël Sarah, Lagacé Karine, Raymond Sylvain, Granger Dominic, Loyer Magali, Bourgoin Sarah et al. Repeatedly washed semen stains: Optimal screening and sampling strategies for DNA analysis. *Forensic Sci Int: Genetics* 2019;38:9-14.
  15. Sukriye Karaday, Elnaz Moshfeghi, Tulin Arasoglu, Beytullah Karadayi. Evaluating the persistence of laundered semen stains on fabric using a forensic light source system, prostate-specific antigen semi quant test, and DNA recovery profiling. *Medicine, Science and the Law* 2020;1-9.
  16. Farmen RK, Cortez Pablo, Frøyland ES. Spermatozoa recovered on laundered clothing. *Forensic Sci Int: Genetics* 2008 October 1;1:1418-420.



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### CASE SERIES

# Presentation and management of nasal dermal sinus: a case series

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**Background and aims:** Nasal dermal Sinus is a relatively rare congenital condition. We have reviewed our experience in the presentation and management of these cases. **Material and methods:** This is a retrospective study from June 2006 to January 2019. Patients presented with a nasal pit, with or without a hair in it, were selected. They were studied for their various aspects before and after the operation. **Results:** Out of eight patients of our series, one presented with infection, and hence operation was done later. One patient's parents refused this operation at one sitting with his other condition, and therefore seven patients were operated on. Complete excision of dermal sinus by midline vertical incision under general anaesthesia was done. One patient had a recurrence and was reoperated 14 years later. Follow-up was from 1 to 13 years, with a mean of 6 years. **Conclusion:** Nasal dermal Sinus and dermal cyst without fistulae are two different entities. Most of the sinuses of this condition do not bear the intracranial extension. Excision can be done from the nose, and cranial exploration is rarely required.

**Keywords:** Nasal dermal sinus; sinus with hair; congenital nasal pit; nasal pilonidal sinus.

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## INTRODUCTION

Nasal dermal sinus in children is relatively a rare disease. A small pit, present since birth in the midline of the nose anywhere from the root of the nasal bridge to the columella base, characterizes it. The opening may have coarse hair coming out from it, and occasionally it discharges white sebum like material. Its incidence is 1:20000 to 1:40000 births.<sup>1</sup> Its Pathogenesis has been explained in various ways. Superficial sequestration or in the development process in the frontonasal region incomplete obliteration of neuroectoderm are the two most accepted theories.<sup>2</sup> Nasal dermal sinus and cyst has been considered as the same spectrum of disease in some papers. Apart from the clinical examination, CT or MRI scan is required to find out size and extension, particularly for the intracranial component, if any.<sup>3</sup>

The condition requires early surgical management. Delay in management can cause infection, fistula formation and scarring. These complications cause disfigurement, and then complete excision of the sinus becomes extremely difficult. If there is any intracranial extension of the tract, the infection may cause meningitis or brain abscess.<sup>4</sup>

The cases of nasal dermal sinus encountered by us have been analyzed here.

## MATERIAL AND METHODS

This is a retrospective cohort study done in the Paediatric Surgery Department of a tertiary medical Centre. Eight patients with nasal dermal sinus were included in this study. The period was fourteen years, from June 2005 to May 2019. Though dermal cyst and sinus terms were used confusingly by some

authors, pure dermal cyst of this region was not encountered in this study. Few cases of mass in the nose and frontonasal area without sinus were encountered. In clinical examinations and investigations, no sinus was found and hence excluded from the study. In all the cases, the family history of a similar sinus was especially enquired. Anteroposterior and lateral X-ray was taken in some early cases to assess the patients, and since 2008 CT or MRI scans were done.

Two patients had associated anorectal malformation with this condition. In one patient, excision of punctum was done along with the pull-through operation. Other patient was offered a simultaneous operation for dermal sinus and the anorectal malformation operation. Investigations were done. But, the parents wanted to postpone the operation for nasal sinus to a

later date. All the eight sittings of operations of the seven patients were done under general anaesthesia. All the excised specimens were sent for histopathological examination. We have obtained the required informed consent from the legal guardian for publishing these works in a scientific journal.

## RESULTS

During this fourteen year study period, we encountered only eight cases of the nasal dermal sinus. Out of these, six patients were male, and two were female. Age of diagnosis ranged from day 2 to 6 years and operation from 5 months to 14 years (**Table 1**).

**Table 1** Age distributions of the patients at presentation and operation

Cases	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7	Case 8
Age at presentation	Day 2	1 yr	6 m	2 yr	1½ m	11 m	6 yr	6 m
Age at operation	5 m & 14 yr	1 yr	9 m	2 yr 2 m	6 m	1 yr	6 yr	Waiting



**Figure 1** 14 years old girl with recurrent congenital nasal dermal sinus

In a female patient, the diagnosis of this condition was made at the neonatal period. She had anorectal malformation as well. The punctum region's incomplete excision was only done at five months of age and her anal transposition operation. She had a recurrence and came for treatment at 14 years of age (**Figure 1**). Re-operation was done with complete excision of the tract.



**Figure 2** Typical case of nasal dermal sinus without any hair in it

Opening in the dorsum of the nose since birth was the leading complaint (**Figure 2**). One patient (Case No 4) had opening in the middle part of the nasal bridge.



**Figure 3** Infected nasal dermal sinus. Punctum can be seen away from the site of infection (Arrow)

He also had slight widening of the nose, inflammatory swelling in the nasal bridge region with a pus discharging sinus on the right side of nasion, close to lacrimal Sinus (**Figure 3**).

The patient was treated with antibiotics and operated on two months later as the infection subsided (**Figure 4**). In another male patient (case number 8), it was an incidental finding. Parents were unaware of the consequences of the condition.



**Figure 4** Postoperative view of the patient of figure 3 after the subsidence of infection

This case was associated with anorectal malformation. Though the patient came to the hospital in the neonatal period, the condition was diagnosed only at six months of age while went for a pull-through operation. Parents wanted to wait for the operation of this condition till the treatment for an anorectal malformation is over. In no patients, a family history of a similar condition was present.

Various locations of the openings are as follows. Six cases had their external openings in the nasal bridge, mainly in the lower part. Each was in the base of the columella and the tip of the nose (**Table 2**). Three patients with the opening in the nasal bridge had single coarse hair coming out of the opening (37.5%).

**Table 2** Locations of external openings with or without hair

Cases	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7	Case 8
External opening	Lower nasal bridge	Lower nasal bridge	Tip of nose	Mid nasal bridge	Base of columella	Junction & bridge of nasion	Lower nasal bridge	Junctio of bridge and tip
Presence of hair/ infection	Hair present	None	None	Infected	None	Hair Present	Hair Present	None

In two cases, the disease was associated with anorectal malformations and out of them, each was from either sex.

Computed tomography (CT) scan [n=3 (37.5%)], magnetic resonance imaging (MRI) scan [n=2 (25%) plain X-ray [n=3 (37.5%) was done. Only X-rays were done in three cases

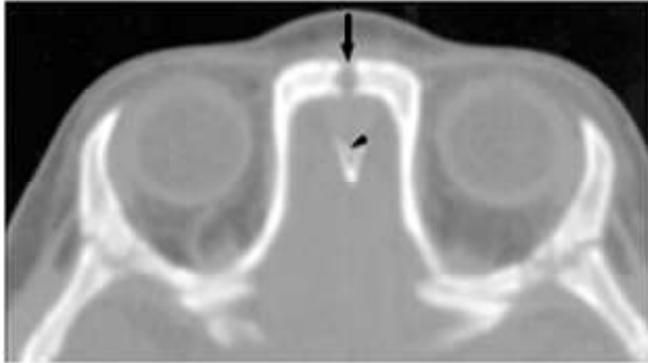
and all these were before 2008.

No sinogram was done.

Changes found in the CT and MRI were identical. There was separation of nasal bones; crista galli was bifid and had



wide foramen caecum (**Figure 5**). The tract of various lengths could be seen in the MRI scan. No cases had the defect of the cribriform plate and evidence of associated intracranial mass.



**Figure 5** CT scan shows separated nasal bone (Arrow) and wide foramen caecum (Arrowhead)

No case of nasal dermal sinus encountered, which had its intra-cranial extension.

All the patients were operated on under general anaesthesia. A midline vertical incision was made in the nasal crest. The punctum was removed in continuity with an encircling incision. The whole tract was dissected out (**Figure 6**). In all the cases, nasal cartilage and nasal bone failed to fuse in the midline, making the dissection easier. The last part of the tract had a thin fibrous cord going towards the foramen caecum divided by sharp dissection. The only complex case was the Case No 4, where skin and deeper structure were adherent due to scarring from a previous infection.



**Figure 6** Excised specimen

No cases required any filling or plastic reconstruction procedure. Postoperative management was as usual. No dressing was applied on the wound from day 2 of the operation.

Histopathological examinations of all the excised tissues were done. In light microscopy, the lining of the sinus was squamous epithelium. Other ectodermal elements like hair

follicle, sebaceous glands, and sweat glands were also noted. In the sinus with hair, the hair originated from a hair follicle lying inside the sinus. No endodermal derivative was noted.

The systemic antibiotic was given to all the cases.

Stitch removal was done on the 5<sup>th</sup> day of operation in most of the cases. In case no four, it was done on day 7. Mean hospital stay was six days.

Except in case no four, where there was a history of the previous infection, scars were nominal.

Due to incomplete excision in the first operation (Case No 1), there was one recurrence. It was reoperated at 14 years of age. This case was followed up for six months, and there is no recurrence to date. In other cases, follow-up was for 1 year to 13 years and meant follow up was six years. There was no recurrence in these cases.

## DISCUSSION

Nomenclature and classification of this condition are confusing.<sup>3</sup> Many authors have used the term dermal sinus and dermal or dermoid cyst of the nose equivocally.<sup>3</sup> In some publications, many unrelated conditions of this region have also been included.

In some studies, a midline nasal mass was the main presenting feature. This was because of the fact mentioned above. As we included only sinus cases, it was the main presenting feature in our series. Hair protruding from the punctum was also a prominent feature. Because of this, some authors have named the dermal sinus of the nose with a hair as Nasal Pilonidal Sinus.<sup>5-7</sup>

Various associated anomalies like ear and craniofacial anomalies were observed in other series.<sup>8</sup> Our series had 2 cases (25%) with anorectal malformation. But no literature with this association was found.

Bifid crista Galli and enlarged foramen caecum in CT and MRI scan is a common sign, and it does not indicate any intracranial extension of the sinus. But the normal-sized foramen confirm the absence of this type of extension.<sup>9</sup> In our series, we found the above bony changes in all the patients, but none had a defect in the cribriform plate. We did not encounter any case with intracranial extension. A narrow fibrous band may be found in the continuity of the tract. It may go beyond the nasal bone up to the nasofrontal suture. Instead of doing extensive dissection, this can be safely divided across at the level of termination of the tubular structure.<sup>10</sup>

Squamous epithelium, sebaceous gland and dermal elements like hair in HPE indicate that this type of sinus develops from ectoderm by sequestration in the fourth to sixth weeks of intrauterine life as forwarded by Bland-Sutton (1893). The presence of a hair follicle differentiates it from the epidermoid cyst (Sebaceous cyst). While the absence of endodermal



element excludes its teratomatous origin.<sup>11</sup>

Many authors employed midline vertical incision. We also employed the same. Many authors advocate other incisions like the transverse, inverted-U, and transnasal approach.<sup>9,11,12</sup> The incisions other than midline vertical type were used for nasal cyst excision and wherever rhinoplasty was required. We did not encounter any difficulty in excising the tracts from the nasal approach. Only case no 4 inverted L shaped incision was employed to excise the scar with the scar of previous infection in continuity.

Recurrence rates in other series were 30% to 100%.<sup>13</sup> Mostly, it was due to incomplete excision and previous infection. In our series, one case out of seven patient operated on had recurrence. There was no recurrence in this case after the second operation. In other cases, there was no recurrence.

## CONCLUSION

The present series is a small one as the condition is rarely encountered in our region. We have included only midline nasal sinuses here without any ambiguity. Hence, in our opinion, paper bears some unique characteristics. In our view, nasal dermal sinus and dermal cyst without fistulae are two different entities. Most of these sinuses are limited to the nose outside the foramen caecum, and intracranial extension is rare. The majority of the cases can be managed by excision through the skin of the nasal region. Cranial exploration is very rarely required.

## REFERENCES

1. Hanikeri M, Waterhouse N, Kirkpatrick N, Peterson D, Macleod I. The management of midline transcranial nasal dermoid sinus cysts. *Br J Plast Surg* 2005;58(8):1043-50.
2. Hedlund G. Congenital frontonasal masses: developmental anatomy, malformations, and MR imaging. *Pediatr Radiol* 2006;36(7):647-62.
3. Rahbar R, Shah P, Mulliken JB, Robson CD, Perez-Atayde AR, Proctor MR, Kenna MA, Scott MR, McGill TJ, Healy GB. The presentation and management of nasal dermoid: a 30-year experience. *Arch Otolaryngol Head Neck Surg* 2003;129(4):464-71.
4. Pollock RA. Surgical approaches to the nasal dermoid cyst. *Ann Plast Surg* 1983;10(6):498-501.
5. Sreedharan S, Kamath PM, Hegde MC, Subramaniam V, Lobo FD. Pilonidal sinus of nose—a diagnostic dilemma. *Jurnalul de Chirurgie* 2010;6:343-7.
6. Jones R. Congenital pilonidal sinus of the nose. *Aust N Z J Surg* 1992;62:492.
7. Montasir Junaaid, Sadaf Qadeer Ahmed, Maliha Kazi, and Naeem Sultan Ali. Pilonidal sinus involving the nasal bridge: a rare manifestation. *BMJ Case Rep* 2015Jul 6; 2015: PMID: 26150636.
8. Wardinsky TD, Pagon RA, Kropp RJ, Hayden PW, Clarren SK. Nasal dermoid sinus cysts: association with intracranial extension and multiple malformations. *Cleft Palate Craniofac* 1991;28(1):87-95. PMID:2004099.
9. Denoyelle F, Ducroz V, Roger G, Garabedian EN. Laryngoscope. Nasaldermoid sinus cysts in children 1997;107(6):795-800. PMID:9185736.
10. Bartlett SP, Lin KY, Grossman R, Katowitz J. The surgical management of orbitofacial dermoids in pediatric patient. *Plast Reconstr Surg* 1993;91(7):1208-15. PMID:8497520.
11. Posnick JC, Bortoluzzi P, Armstrong DC, Drake JM. Intracranial nasal dermoid sinus cysts: computed tomographic scan findings and surgical results. *Plast Reconstr Surg* 1994;93(4):745-54; discussion 755-6. PMID:8134433.
12. Bradley PJ. Results of surgery for nasal dermoids in children. *J Laryngol Otol* 1982;96(7):627-33. PMID:7086278.
13. Vibe P, Lontoft E. Congenital nasal dermoid cysts and fistulas. *Scand J Plast Reconstr Surg* 1985;19(1):105-7. PMID: 4023638.



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### CASE REPORT

# Topical granulated sugar for a prolapsed uncomplicated stoma

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### ABSTRACT

Prolapse of stoma is a well-described complication after ileostomy or colostomy and is typically asymptomatic and easily reducible. Manual reduction is generally successful, but it may be unsuccessful in several cases with edematous prolapsed bowel. Unsuccessful reduction in elderly patients and in hemodynamically unstable or patients with co morbidities may advocate the need for emergent laparotomy which carries high risk of morbidity. As such we advocate the use of osmotic agent, specially granulated sugar as an alternative method for conservative management of prolapsed stoma in targeted population.

**Keywords:** Ileostomy; colostomy; complications; laparotomy; osmotic agent; dessicant.

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### INTRODUCTION

A prolapsed stoma is the telescoping out of the inner lining of the bowel from within the stoma. It is one of the most distressing complications of stoma creation. The long-term complication rate with stomas is variable. The incidence of stomal prolapse has been reported in up to 22% in adults and 38% in children.<sup>1,2</sup>

Prolonged exposure of the prolapsed stoma can lead to mucosal ulcerations, bleeding and incarceration. Manual reduction of the stoma must be tried, but due to edema and incarceration on many occasions, it is unsuccessful owing to difficulty in manipulation. An irreducible prolapse might necessitate surgical correction associated with morbidities, especially in the elderly population and people with comorbidities. A successful reduction can eliminate the need for emergency surgery and allow planning for elective surgery

later. Here we suggest a simple method that can be applied to alleviate the need for emergency surgery.

### CASE REPORT

A 55-year-old gentleman presented to emergency with a prolapsed ileostomy. He had undergone ileostomy for multiple perforations following typhoid two weeks back. He underwent resection and anastomosis of the perforated segment followed by a proximal ileostomy (**Fig. 1**).

He is a known case of uncontrolled diabetes mellitus and dyselectrolytemia. Gentle manual reduction of the prolapse was attempted but failed because of gross edema. 500 grams of granulated table sugar was then applied to the stoma for 15 minutes, and the gentle reduction was tried again successfully (**Fig. 2**).

The stoma was successfully reduced; the patient was kept



**Figure 1** Prolapsed ileostomy



**Figure 2** Reduction in prolapsed ileostomy seen following application of sugar

in the hospital to observe any potential complications further. The patient was safely discharged after the management of dyselectrolytemia and diabetes mellitus. At the time of writing, 6 weeks have passed following the successful reduction, and he has not had a recurrence.

## DISCUSSION

Some surgeons have proposed fascial fixation at initial operation, whereas some surgeons prefer to create a minor fascial defect to prevent stoma prolapse.<sup>3</sup> Once stoma prolapse occurs in temporary ileostomies, conservative approach is generally successful. The case can be taken up for elective operation at a later date for re-establishment of intestinal continuity. Surgical options include simple fixation with or without resection of redundant bowel and stoma relocation to treat prolapse of permanent stomas. In our case, we tried to reduce the prolapsed stoma using granulated sugar. There have been reports of the use of icing sugar for the same purpose.<sup>4</sup> Icing sugar has a smaller granule size and has a high surface area to volume ratio. One obvious disadvantage of the method is that it is not readily available, whereas granulated sugar is readily available in cafeterias in hospital and at a low cost. Manual reduction of an incarcerated stoma can be assisted with conscious sedation and desiccants such as witch hazel and sugar. Veterinarians

initially described these techniques in conditions such as bovine uterine prolapse.<sup>5</sup> In the few reports found in the surgical literature, after the failure of manual reduction using continuous pressure, reduction was quickly and easily accomplished using sugar as a mean to reduce tissue edema.<sup>5</sup> Few other case reports are available in pediatric age group on the use of granulated sugar.<sup>6</sup> The technique uses granulated sugar, which is applied generously on top of the prolapsed bowel. The sugar acts as a desiccant and a topical osmotic agent. It draws water out of the swollen bowel and thus enables its easy or spontaneous reduction. The benefits of successful reduction can be significant, especially in poor surgical candidates spared from an emergent laparotomy.

## CONCLUSION

We conclude that even though the procedure is not very technical and skill-oriented, sugar as the osmotic agent in the patient has proved to be effective, since it avoided performing an emergency laparotomy and sedation and anaesthesia. Moreover, the technique is simple and can be undertaken efficiently in rural health care facilities by nurses to reduce the edema before referring the case to tertiary health care. In patients that meet the criteria for conservative management of prolapsed stoma, with the absence of necrosis and unsuccessful attempts of manual reduction, this procedure should be considered an alternative before open surgery.

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## REFERENCES

1. Duchesne JC, Wang YZ, Weintraub SL, Boyle M. Stoma complications: A multivariate analysis/discussion. *The American Surgeon* 2002 Nov 1;68(11):961.
2. Millar AJ, Lakhoo K, Rode H, Ferreira MW, Brown RA, Cywes S. Bowel stomas in infants and children. A 5-year audit of 203 patients. *S Afr J Surg* 1993 Sep 1;31(3):110-113.
3. Shapiro, R., Chin, E.H. & Steinhagen, R.M. Reduction of an incarcerated, prolapsed ileostomy with the assistance of sugar as a desiccant. *Tech Coloproctol* 2009;14(3):269-271.
4. Theofanis G, Saedon M, Kho SH, Mulita F, Germanos S, Leung E. Avoiding emergency stoma surgery with the use of sugar. *Br J Nurs* 2017 Dec 14;26(22):S24-6.
5. Mohammed O, West M, Chandrasekar R. Granulated sugar to reduce an incarcerated prolapsed defunctioning ileostomy. *BMJ Case Rep* 2013 Feb 28;2013. DOI: dx.doi.org/10.1136/bcr-2012-007565.
6. Júnior JA, Júnior JV, Forte HB, de Vasconcelos LM, Bezerra MM. Topical osmotic therapy for a prolapsed incarcerated ostomy. *J Pediatr Surg Case Rep* 2020 Apr 15:101454.



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### CASE REPORT

# Unusual Pregabalin dependence following opioid detoxification: a case report

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### ABSTRACT

A 20 year old unmarried male belonging to high socioeconomic status was initially treated with low dose of Buprenorphine for severe opioid withdrawal. Most of the withdrawal symptoms and signs subsided following the treatment, but few symptoms such as sleep disturbance and mild bodyache persisted after 4 months of detoxification. To alleviate his symptoms, he initially started with 3-4 tablets of pregabalin (75 mg) per day which he could get from the pharmacy without any prescription. He gradually increased the dose day by day. Finally he was taking around 40 tablets per day which is approximately 3000 mg of pregabalin per day. He was admitted in the Psychiatry Department and the pregabalin was gradually tapered. High dose of long acting Benzodiazepines was initiated and he also received few sessions of motivation enhancement therapy (MET) and relapse prevention (RP).

**Keywords:** Abnormal; Unusual; Pregabalin; Opioid; Dependence.

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### INTRODUCTION

Manipur is a Northeastern state of India which has a high prevalence of drug abuse. One of the main reasons for the same is that it shares international boundary with Myanmar, which is a part of the "golden triangle" which includes Myanmar, Laos and Thailand. Golden triangle is considered to be one of the largest opium producers of the world.<sup>1</sup>

Drug dependence is characterized by a strong and excessive desire to take a drug, withdrawal state when not taking the drug, tolerance to the drug, difficulty in controlling drug taking behaviour, inability to derive pleasure in alternative activities and persistent use of drug despite clear evidence of harmful consequences.<sup>2</sup> Pregabalin is a gamma-aminobutyric acid

(GABA) analogue and it reduces the release of numerous neurotransmitters including glutamate, noradrenaline, and substance P.<sup>3</sup> Pregabalin was reported as having very low abuse potential in pre-marketing studies and had a very limited potential for developing addiction even when abused.<sup>4</sup> But recent data and number case reports suggests that pregabalin is associated with increased potential of abuse or addiction in patients with a history of opioid abuse or current opioid addiction.<sup>5-6</sup>

### CASE HISTORY

A 20 years old unmarried male belonging to high socioeconomic status attended psychiatry OPD for the treatment of Pregabalin dependence. He was admitted in male



De-addiction ward for proper assessment and management. Detailed history revealed that he had undergone detoxification in the past for Heroin dependence with low dose of Buprenorphine. His treatment was completed 4 months ago and most of the withdrawal symptoms and signs subsided following the treatment. However few symptoms such as sleep disturbance and mild body ache persisted even after initial few days of detoxification. To alleviate his symptoms, he initially started with 3-4 tablets of pregabalin (75 mg) per day which he could get from the pharmacy without any prescription. He was feeling good and most of his symptoms also improved with pregabalin. He could sleep well and felt something great happening inside his head. He gradually increased the dose day by day. Finally he was taking around 40 tablets per day which is approximately 3000 mg of pregabalin per day. He tried to decrease and stop using tab pregabalin by himself but failed and hence came to Department of Psychiatry, RIMS.

## INVESTIGATION

Complete hemogram, LFT, KFT, RBS, urine R/E, TFT and ECG was within normal limits. Hepatitis B, C, HIV was non reactive.

## TREATMENT

High dose of long acting Benzodiazepines was initiated and his dose of pregabalin tapered gradually and stopped altogether within 14 days of treatment. He also received few sessions of motivation enhancement therapy (MET) and relapse prevention (RP) therapy from the psychologists.

He was started on tab Clonazepam 2mg/day in divided doses and Tab Zolpidem 12.5 mg at bed time. Tab clonazepam was tapered over a period of 15 days and then stopped. The hospital stay was uneventful except some restlessness, sleep disturbance in the initial days. He also received sessions of motivation enhancement therapy and relapse prevention counseling and he was discharged after 16 days.

## DISCUSSION

Pregabalin is an analogue of the neurotransmitter gamma aminobutyric acid (GABA) that selectively bind to the  $\alpha 2-\delta$  subunit of voltage-gated calcium channels in central nervous system neuronal tissues.<sup>1</sup> They inhibit the release of excitatory neurotransmitters resulting in the antinociceptive, anticonvulsant, anxiolytic and sleep-modulating activities. So they may be used to achieve euphoric and dissociative effects. Pregabalin is also approved for the treatment of neuropathic pain, partial seizure and generalized anxiety disorder. As a GABA analogue there is a raising concern regarding the abuse potential of this drug.<sup>7</sup>

Drug addiction remains a widespread and fatal disease worldwide that results in serious social and economic impacts. Recent studies suggest that illegal pregabalin use may be increasing among young people, however the addictive

potential of pregabalin is not properly established and there are less documented cases of pregabalin abuse.<sup>8-9</sup>

There are as such no guidelines for the treatment for pregabalin abuse or dependence. As benzodiazepines results in increase in the effect of neurotransmitter GABA at GABAA receptor and as pregabalin is an analogue of neurotransmitter GABA, detoxification was tried by using tab clonazepam.

## CONCLUSION

The case highlights the illicit dispensing practices in the state. Improper regulation of drugs result in indiscriminate dispensing by pharmacists. Physicians should also be aware of the addictive potential of pregabalin and prescribe it with caution, more so in patients with a previous history of substance abuse.

## REFERENCES

1. Singh AD, Kaul RK, Sharma SG, Singh KC, Singh YM, Singh TB, et al. Survey of drug abuse in Manipur state -a report. Manipur: Committee for Prevention of Drug Abuse (COPDA), Indian Medical Association, Manipur State Branch; 1992.
2. International Classification of Functioning, Disability and Health. [cited 2021 June 5]. Available from: <https://www.who.int/standards/classifications/international-classification-of-functioning-disability-and-health>.
3. Shneker BF, McAuley JW. Pregabalin: a new neuromodulator with broad therapeutic indications. *Ann Pharmacother* 2005;39:2029-37.
4. European Medicines Agency (EMA). Lyrica (pregabalin) scientific discussion. Erisim. [cited 2021 June 05]. Available from: [http://www.ema.europa.eu/docs/en\\_GB/document\\_library/EPAR\\_-\\_Summary\\_for\\_the\\_public/human/000546/WC500046603.pdf](http://www.ema.europa.eu/docs/en_GB/document_library/EPAR_-_Summary_for_the_public/human/000546/WC500046603.pdf).
5. Gahr M, Franke B, Freudenmann RW, Kölle MA, Schönfeldt-Lecuona C. Concerns about pregabalin: further experience with its potential of causing addictive behaviors. *J Addict Med* 2013;7:147-9.
6. Grosshans M, Mutschler J, Hermann D, Klein O, Dressing H, Kiefer F, et al. Pregabalin abuse, dependence, and withdrawal: a case report. *Am J Psychiatry* 2010;167:869.
7. Pfizer Inc. Prescribing information: Lyrica, 2011. [cited 2021 June 05]. Available from: <http://www.pfizer.com/products/product-detail/lyrica>.
8. Althobaiti YS, Almalki A, Alsaab H, Alsanie W, Gaber A, Alhadidi Q, et al. Pregabalin: Potential for Addiction and a Possible Glutamatergic Mechanism. *Sci Rep* 2019;9(1):15136.
9. Driot D, Jouanous E, Oustric S, Dupouy J, Lapeyre-Mestre M. Patterns of gabapentin and pregabalin use and misuse: Results of a population-based cohort study in France. *Br J Clin Pharmacol* 2019;85(6):1260-9.





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### REVIEW PAPER

# Dental Biofilm and periodontal disease

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Oral health is an essential aspect of general health and is considered an integral component of an individual's overall health and well-being. Various forms of oral diseases, including gingival and periodontal diseases, have affected the human population since prehistoric time. Several research studies have convincingly established the role of the dental biofilm in the initiation and progression of various forms of periodontal disease. Studies have also shown the link between poor periodontal health and the systemic health of an individual. In this article, an attempt has been made to highlight dental biofilm and its role in the initiation and progression of periodontal diseases. In the recent time, much importance to oral health has been given as studies have shown that periodontal diseases are associated with various systemic diseases like diabetes mellitus, preterm low birth weight babies, chronic obstructive pulmonary disease, heart attack and stroke.

**Keywords:** Dental biofilm; gingivitis; periodontitis; oral health; World Health Organization.

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## INTRODUCTION

The most common oral diseases that affect the human population globally are dental caries and periodontal disease. These two diseases are responsible for a substantial number of teeth losses all over the world. The world health organization (WHO) has recognized oral diseases as a serious public health problem. The WHO stated that despite significant improvements in the oral health status of populations worldwide, oral health problems are still prevalent at a large scale, especially among the underprivileged groups in developed and developing countries.<sup>1</sup> India is a developing country, and various studies reported a high prevalence of oral diseases.<sup>2,3</sup> The National Epidemiological Oral Health Survey and Fluoride Mapping of India report (2002-2003) stated a high prevalence of gingival and periodontal diseases. In its report, Gingival and Periodontal diseases are prevalent in 67.7% of 15-year-olds and 89.6% of (35-44) years old, which is relatively higher than dental caries in our country.

The most common form of the gingival disease is dental plaque-associated gingivitis. Dental plaque has been identified and recognized as a dental biofilm. The inflammation of the soft tissues around a tooth leads to the development of

gingivitis. Gingivitis is part of the broader classification of periodontal diseases, where gingivitis is included at the milder end, and periodontitis has been included at the more extreme end of periodontal disease. The cause of gingivitis and periodontitis is considered to be primarily bacterial substances in dental plaque.<sup>4</sup> The association of dental plaque with the development of gingivitis is well established. Loe H. et al. had convincingly demonstrated the role of dental plaque in the initiation and progression of gingivitis in their classic human experimental gingivitis model.<sup>5</sup> They had also shown that plaque-induced gingivitis is a reversible disease. With adequate supragingival plaque control, gingivitis cases can be reverted to a healthy state. It is also known that if not adequately treated, some cases of gingivitis may progress to periodontitis. Periodontitis is an advanced stage of periodontal disease that slowly destroys the tooth-supporting structures, leading to the loss of teeth at an early age. The pathogenesis of periodontitis is complex. Several critical factors, including host immunity and host-microbial interaction, are involved in determining the progression of a case of gingivitis to a more advanced form of periodontitis. It is challenging to differentiate between stable gingivitis from progressive gingivitis or the time at which progressive gingivitis will turn

into a destructive form of periodontal disease. Therefore, prevention of gingivitis, early diagnosis, and treatment of gingivitis is the most practical ways to prevent periodontitis, which is considered a significant global public health problem. A better understanding of the dental biofilm and its role in the etiopathogenesis of dental and periodontal diseases will help to control oral diseases.

## DENTAL BIOFILM

Dr G V Black (1898) initially used the term plaque in dental caries to describe the felt like a mass of microorganisms over carious lesions. Dental plaque is a highly organized ecologic unit consisting of masses of bacteria embedded in an amorphous matrix of macromolecules synthesized by increasing bacteria and constituents of the crevicular fluid.<sup>6</sup> In recent years, dental plaque has been identified as a biofilm, a complex, communal, three-dimensional arrangement of bacteria. Dental plaque biofilm is recognized as the organized soft deposit adhering tenaciously to the teeth surfaces or other hard surfaces in the oral cavity, including removable and fixed restorations. The moist environment, a relatively constant temperature of (34-36) degree centigrade, PH close to neutrality in most areas of the oral cavity, provides a favourable environment for the growth of a wide variety of microorganisms. However, all areas of the oral cavity are not precisely similar in their environment. Based on physical and morphologic criteria, six major ecosystems have been identified in the oral cavity. Each of the ecosystems in the oral cavity is characterized by different physicochemical factors and supports the growth of different microbial community types. Anatomical diversity and the interrelationships between the other anatomical structures play a determining role in microbial growth on the oral cavity structures. Teeth serve as non-shedding hard surfaces and provide many different sites for colonization by bacteria on the supragingival and the subgingival areas.

On the other hand, oral mucosa is characterized by continuous desquamation of its surface epithelial cells, which readily eliminates bacteria from the mucosal surfaces. The tongue with its papillary characters provides sites of colonization that are not easily reached by the regular mechanical oral hygiene devices. The gingival crevice also offers a unique colonization site that includes both the hard and soft tissues of the gingiva. Saliva and the gingival crevicular fluid (GCF) constantly bathes the oral surfaces and are essential for maintaining the oral ecosystems by providing water, nutrients, adherence and antimicrobial factors.

The supragingival environment is regularly exposed to saliva, and the subgingival environment, gingival crevice, are exposed to the gingival crevicular fluid. Saliva contains approximately 90 per cent water along with hormones, vitamins, urea and several ions. The diffusion of gingival crevicular fluid (GCF) in healthy gingiva is slow but increases in inflammatory conditions, and it contains proteins, albumins, leukocytes,

immunoglobulins and complements. The subgingival area, which is bathed by GCF, usually escapes from the salivary buffering activity. The PH of the gingival crevice may vary between 7.5 and 8.5 and provides an environment where selective periodontopathogens multiplies and results in the formation of dental plaque. Biofilm in supra and subgingival plaque is the etiological agent of various gingival and periodontal diseases.<sup>7</sup>

The first event in the formation of the supragingival dental biofilm is the deposition of salivary components on the tooth surfaces known as the acquired pellicle.<sup>6</sup> The formation of this biological film is a prerequisite for the adhesion of bacteria over the tooth surface. The pellicle is a structureless, acellular film of glycoproteins, making the surface receptive to colonization by specific bacteria. Acquired pellicle formation begins within minutes after professional scaling and root planing, and microorganisms get attached to this pellicle as rapidly as within one hour. Gram-positive cocci and rods are the early colonizers on this pellicle. Gradually, a phenotypic change in bacteria occurs from planktonic to sessile type. As a result, genetic expression shifts and is followed by a short lag in bacterial growth.

Afterwards, a phase of rapid growth results, following the secretion of large amounts of water-insoluble extracellular polysaccharides to form the biofilm matrix, where the growth of microcolonies occurs. With the advancement of time, different varieties of bacteria adhere to the early colonizers, a phenomenon known as coaggregation resulting increase in bacterial complexity and structural stratification, which ultimately increases the thickness of the biofilm. Following this phase, bacteria in the interior of the plaque biofilm slow their growth and become static which is termed a steady-state phase. Bacteria lying deep in the biofilm show degenerative changes, but the bacteria lying near the surfaces remain intact. Surface detachment and sloughing of bacteria from the biofilm occurs, and they can form new colonies in different areas of the oral cavity. Bacterial communities living in a biofilm possess innovative survival strategies, including a broader habitat for growth, nutrition, waste elimination, new colonization, environmental niches for safety, barriers to thwart antimicrobial drug therapy, protection from the host's defence system including phagocytosis and enhanced pathogenicity.<sup>8,9</sup> The bacterial mass produces several cytotoxic and chemotactic substances within the plaque. Products of metabolism and residual effects after lysis of bacterial cells and extracellular substances synthesized by bacteria like ammonia, sulfide, amines, indole, skatole, and organic acids can damage the gingival epithelium and connective tissue. The pathogenicity of the dental plaque biofilm is a matter of concern to clinicians. In the biofilm form, the component bacteria have increased resistance to antibiotics and other chemotherapeutic agents and are less susceptible to phagocytosis the host inflammatory cells. Practically dental biofilm cannot be eliminated, but it can be

adequately controlled with comprehensive mechanical and chemotherapeutic oral hygiene procedures, which are considered to be critical in the long term maintenance of oral health.<sup>10,11</sup>

## DISCUSSION

The mildest form of periodontal disease is dental biofilm induced gingivitis, an inflammatory condition of the gingiva. Various studies show that gingivitis affects more than 90 percent of the population regardless of age, sex or race. The classic experimental study of gingivitis on the human model by H Loe et al., convincingly demonstrated the causal relationship between the quantity of bacterial plaque and the degree of gingivitis.<sup>5</sup> If adequate measures are not taken, some cases of gingivitis may progress to periodontitis, a condition where the supporting structures of the periodontium involve. A better understanding of the pathogenesis of periodontitis revealed that several factors, including host factors, determine the susceptibility of an individual to periodontitis. The host factors modulate the body's response to the accumulation of dental biofilm resulting in differences in the development of gingivitis and its progression to periodontitis. If not adequately treated at the early stages, constant stimuli from the dental biofilm will cause inflammation to continue for an extended time, resulting in chronic gingivitis. Epidemiological studies show that chronic gingivitis is the most prevalent type of inflammatory gingival lesion of our population. Most of our population ignores the condition. For a long time, gingivitis is not being treated, resulting in exposure of the body to continuous low-grade chronic bacteremia, which may affect systemic health. Several studies have shown that patients with periodontal diseases demonstrate elevated C-reactive protein levels (CRP), fibrinogen, and an increase in the number of white blood cells.<sup>12,13</sup> An increased fibrinogen and C-reactive protein level has been suggested to be risk factors for cardiovascular disease and stroke by causing vascular injury and atherogenesis. Chronic obstructive pulmonary disease (COPD) has been associated with poor oral hygiene and poor oral health.<sup>14</sup> Adverse pregnancy outcomes like preterm low birth weight babies are also being associated with periodontal inflammatory diseases.<sup>15,16</sup>

Because of the local and systemic consequences of gingival and periodontal diseases, and because many of our population are suffering from this disease, it has become necessary to educate ordinary people regarding the etiological role of dental plaque in the initiation and progression of periodontal diseases. Plaque induced gingivitis is a reversible disease if appropriate measures are taken at the initial stage, which may prevent more destructive forms of periodontal disease.

## CONCLUSION

Because of the widespread prevalence of periodontal diseases and the shortage of technical human resources, and the economic constraint of the common people of developing

nations like India, it has become necessary to concentrate on preventive and affordable treatment measures to control and treat gingival periodontal diseases at the community level. A better understanding of the role of dental biofilm in etiopathogenesis and the progression of dental caries and periodontal diseases have given us practical ways to control these two most widely prevalent diseases in our community. Therefore, dental health care providers have a great responsibility to educate the common people regarding controlling dental biofilm to prevent caries and periodontal diseases at the community level. This will help to achieve not only better oral health but will also help to improve the overall health of an individual.

## REFERENCES

1. WHO, Geneva, Epidemiology, etiology and prevention of periodontal disease; Technical report series 1978;621:7-19.
2. Pilot T, Barmes DE, Leclercq MH, Mc Combie BJ, Sardo IJ, Periodontal conditions in adolescents, 15-19 years of age. An overview of CPITN data in the WHO Global oral data Bank. Community Dent Oral Epidemiol 1987;15:336-338.
3. Ramfjord SP. The periodontal status of boys 11 to 17 years old in Bombay, India. J Periodontol 1961;32:237-248.
4. Breuer MM, Cosgrove RS. The relationship between gingivitis and plaque levels. J Periodontol 1989;60(4):172-75.
5. Loe H, Theilade E, Jensen SB, Experimental Gingivitis in man. J periodontal 1965;36:177-87.
6. Ramfjord SP, Ash M M. Periodontology and Periodontics Modern Theory and practice, First edition 1996;61-73.
7. Haffajee AD Socransky SS, Microbial etiological agents of destructive periodontal disease periodontal 2000;1994; 5: 78-111.
8. Costerton JW, Stewart PS, Greenberg EP. Bacterial biofilm, a common cause of persistent infections. Oral Science 1999;284:1318-1322.
9. Loesche WJ., chemotherapy of dental plaque infections. Oral Science Rev 1976;6:65-107.
10. Hellstrom MK, Ramberg P, Krok L, Lindhe J., The effect of supragingival plaque control on the subgingival microflora in human periodontitis. J clin periodontol 1996 Oct 23;(10):934-40.
11. Lang NP, Cumming BR, Loe H., Toothbrushing frequency relates to plaque development and gingival health. J Periodontol 1973;44:396-405.
12. Mattila KJ, Valtonen VV, Nieminen M, et al. Dental infection and the risk of new coronary events: Prospective study of patients with documented coronary artery disease. Clin Infect Dis 1995;20:588.
13. Syrjanen J, Valtonen VV, Iivanainen M, et al. Preceding infection as a significant risk factor for ischemic brain infarction in young and middle-aged patients. Br Med J 1988;296:1156.
14. Grau AJ, Buggle F, Heindl S, et al. Clinical and biochemical analysis in infection-associated stroke. Stroke 1995;26:1520.



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### REVIEW PAPER

# Enamel surface damage during debonding of ceramic brackets: a brief review

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### ABSTRACT

Like general dentistry, the orthodontic speciality also felt the need for aesthetic orthodontic appliances due to increased demand among adult patients, which has led to the development of various aesthetically superior devices. Since the ceramic brackets (CB) were introduced to the orthodontic speciality, they have become an integral part of the armamentarium for this speciality. The makeup and clinical performance have greatly improved. Compared to conventional stainless-steel brackets (SSB), the superior aesthetics of CB are not only well accepted by the patient, particularly by adults. However, the brittle nature of CB has resulted in a high incidence of bracket failure like a fracture during debonding using different techniques. This review paper has reread the effectiveness of different debonding strategies for CB and appraises the enamel surface damages caused by it.

**Keywords:** Debonding techniques; scanning electron microscopy (SEM); effectiveness.

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### INTRODUCTION

Ceramic brackets (CBs) were introduced to an orthodontic speciality in the mid-1980s; it has become an integral part of the orthodontic profession.<sup>1</sup>

The CB has the unique characteristic of being more esthetic than metal brackets. There are two types of these brackets, viz. polycrystalline and monocrystalline, composed of 99.9% aluminium oxide. The most apparent difference between polycrystalline and single crystal brackets is in their optical clarity. Single crystal brackets are noticeably more precise than polycrystalline brackets, which tend to be translucent.<sup>2</sup>

#### Effectiveness of different debonding techniques for ceramic brackets

Although CB is more esthetic, many clinicians refrain from using them because of many potential problems and difficulty

encountered during debonding. The brittle nature of CB has resulted in a high incidence of bracket failure like a fracture during debonding. Debonding may be time-consuming, painful damaging the enamel surface if performed with improper technique.<sup>3-7</sup>

Reports of enamel fracture and cracks during debonding have raised questions about the safety of various procedures used to remove these attachments.<sup>6,8</sup> However, the tensile strength of ceramic is greater than that of stainless steel; less energy is used to cause fracture of CB compared with conventional SSBs.<sup>9</sup> This phenomenon is related to fracture toughness or the ability of a material to resist fracture. The CB has substantially less fracture toughness when compared to SSBs.<sup>1,2</sup>

During loading, CB will elongate approximately 20% of its original length before failing.<sup>2</sup> A shallow scratch on the surface

or microscopic crack will drastically reduce the load required for fracture of CBs.<sup>2,10</sup> Stresses introduced during the ligation and archwire activation, forces of mastication and occlusion, and forces applied during bracket removal with pliers or debonding instruments are all capable of creating microcracks in CBs that can lead to failure.<sup>7,11,12</sup>

The adhesion between the resin and CB base has increased to a point where the most common bond failure site during debonding has shifted from bracket base adhesive interface to enamel adhesive interface, increasing the risk of enamel damage less desirable.<sup>7,13</sup> This shift has led to an increase in the incidence of bond failures within the enamel surface.<sup>14</sup> Enamel surface damage is a common problem during debonding of CBs.<sup>1,2,6-8</sup>

Monocrystalline CBs display more enamel loss than polycrystalline brackets because the bonding mechanism in monocrystalline brackets only involves chemical adhesion. Still, in the case of polycrystalline, it is by both micromechanical and chemical adhesion.<sup>6</sup>

CBs with chemical retention causes more enamel damage than those with mechanical retention<sup>2</sup> and several other studies have reported the injuries during debonding procedures<sup>1,2,6-8</sup>. Investigators who have attempted to develop an optimal method of removing orthodontic metal brackets have concluded that applying a force that peels the bracket base away from the tooth and causes bond failure at the adhesive-bracket interface is the most consistently atraumatic debonding technique. However, because of the nature of the CBs, the debonding method that employs such force often results in a fracture.

Hence, various debonding techniques were initiated, especially for CBs, including debonding pliers and ligature cutting pliers to apply a squeezing force at the bracket base and using a shear torsion force with a specially designed instrument.<sup>2,15</sup> Alternate debonding techniques that minimize the potential for bracket failure and trauma to the enamel surface during debonding have also been initiated. Ultrasonic debonding tips specially designed tips applied at the bracket adhesive junction.<sup>1,7,8</sup> Thermal debonding has also been suggested as a method for debonding CBs.<sup>16</sup>

Apart from understanding the amount of enamel surface damage caused by the debonding instruments, it is necessary to assess the ease and time required in debonding CBs they all function in different principles.

After debonding orthodontic brackets, the quality of enamel surfaces was assessed under clinical and experimental conditions utilizing stereomicroscope and SEM. Orthodontic attachments were direct-bonded with either of two diacrylate resin adhesives. After bracket removal with a ligature cutter, remnants of adhesive on the tooth surface were removed employing various rotating instruments at low speed.<sup>12</sup> A particular replica technique made it possible to make sequential

assessments of step-by-step polishing procedures and directly follow the gradual reduction and possible disappearance of individual scratches in the microscope.<sup>12</sup>

The cracks are more in both debonded and debonded groups than the untreated teeth. The majority of the cracks were oriented in a vertical direction, and most were localized in the gingival, two-thirds of the facial surface of the teeth. Few horizontal and oblique cracks were observed, mainly on the central incisors of both arches. They showed that post-treatment presence of many horizontal cracks or pronounced vertical cracks may indicate improper debonding technique.<sup>17</sup>

The SEM showed that the fracture site upon removing the bracket runs mainly in a heterogeneous way, partly along with the bracket/adhesive interface within the adhesive material and the adhesive/enamel interface and within the enamel.<sup>2</sup>

In some cases, localized enamel fracture was seen reaching down to a maximal depth of 100 micrometres. In bracket removal cases, 13.3% of enamel tear-off were visible in the form of a rippled or terraced surface roughness. The terrace-like appearance of enamel detachments may be caused by the specific arrangement of the striae of Retzius. Brackets with enamel fracture needed tensile forces of 9 to 11 N/mm<sup>2</sup> for removal. Areas of fractured enamel could not be repaired by thoroughly enamel polishing with various instrumentation TC bur, scalar, and green rubber. About 55µm of enamel surface is lost through acid etching, bracket removal, and enamel polishing. The micromorphological findings showed clearly that the direct-bonding technique entails an artificial weakening of the superficial enamel structure.<sup>18</sup>

The electrothermic debonding method can be an alternative to conventional methods of removing bonded brackets. Here the unit induces sufficient heat in the bonded bracket to alter the bracket-adhesive interface without causing an excessive increase in pulpal wall temperatures.<sup>19</sup>

The debonding of CBs with a mechanical retention base is much easier because of the lack of bond strength. During debonding, compressing the wings as in metal brackets will result in a brittle fracture of CB. Increasing the load to the adhesive-enamel interface also increases the risk of enamel surface damage. A slow, gradual compression mesiodistal to the base would seem to offer the best chance for inducing crack propagation within the bonding adhesive rather than the enamel.<sup>3</sup>

The comparison of the shear bond strength values of commercially available CBs with those of metal brackets and also noted the site of bond failure. Polycrystalline brackets were bonded with a concise orthodontic bonding system, and the test was carried out on an Instron Machine. The study showed mean shear bond strength of 18.3 MPa for



Allure brackets, 18.8 MPa for Transcend brackets, and the failure site was resin/bracket for Allure, primarily at resin/enamel for transcending brackets. Metal brackets showed a mean shear strength of 12.9 MPa and failure at the resin/bracket interface.<sup>9</sup>

The enamel loss resulting from orthodontic removal is minimized by first debonding the bracket with the bracket removing pliers followed by ultrasonic technique. It also showed that the ultrasonic method is the most time consuming, and the combined plier ultrasonic process takes the least time to debond.<sup>20</sup>

The tensile strength of ceramics is not a simple bulk material property. It is dependent on the condition of the surface of the ceramics. A shallow scratch on the ceramic surface will drastically reduce the load required for fracture, whereas the same scratch on a metal surface will have little effect on fracture under load. The fracture toughness for stainless steel is more than that for polycrystalline alumina.<sup>21</sup>

The possibility of enamel fracture after removal of CBs with silane couplers is also seen. The bond failure at the bracket/resin interface was considered preferable. If the failure occurs heterogeneously at the resin/enamel interface, it may lead to uncontrolled fracture within the enamel. Clinicians should avoid debonding over craze lines, which may be inherently weakened areas that lead directly into areas of fractured enamel.<sup>5</sup>

The three different debonding techniques on CBs are the debonding pliers, ultrasonic method and electrothermal method. The maximum amount of adhesive remaining after bracket removal was with debonding pliers. The debonding time was minimal for debonding pliers. The enamel damage resulting from adhesive removal was not significantly different among the three techniques used.<sup>7</sup>

As enamel fracture on the debonding of SSBs is not frequently reported, it can be concluded that the shear bond strength of the CBs to enamel is not, by itself, the cause of these reported enamel fractures. The highest predictability and the highest bond strength were both found with the polycrystalline bracket system.<sup>22</sup>

When stretched, the failure loads and the strength of monocrystalline brackets dropped dramatically while the strength of polycrystalline brackets remained about the same. Polycrystalline brackets had many more initial surface flaws, making them weaker than single-crystal brackets. Still, after scratching, the strength remained relatively unchanged, indicating a higher fracture toughness for polycrystalline brackets. Different ligation had no significant effect.<sup>23</sup>

The risk of enamel damage when debonding CBs is not greater than the risk when debonding metal brackets. There was a significant difference in the adhesive remnant index scores between metal and the chemically retained ceramic bracket,

but there was no significant difference in the adhesive remnant index scores was found between the metal and the mechanically retained CBs.<sup>24</sup>

The SEM detect more enamel damage caused by debonding of CBs than standard twin metal brackets. However, CBs using mechanical retention appears to cause enamel damage less often than those using mechanical than those using chemical retention. It was also showed that the pistol type debonding instrumental is more comfortable for patients and less potential for enamel damage.<sup>11</sup>

Brackets were bonded and removed by grinding with high and slow speed burs with or without air or coolant. When high-speed diamond bur and water spray cooling was used, pulpal temperature dropped from an initial 37°C to 23.5°C at completion. Removal of CBs with low-speed green stone burs and no coolant may cause permanent damage or necrosis of the dental pulp. Water coolant provides the most significant cooling of the grinding sites in high speed and low bracket removal.<sup>25</sup>

Most bond failures occurred at the tooth-adhesive interface with the light cure for Transcend Brackets in shear mode. In a tensile manner, monocrystalline brackets experienced a large number of wing fractures. The polycrystalline transcend brackets that underwent wing fracture did so at the highest base stress, a mean of 16.0 MPa. The study showed that the shear bond strength of ceramic was not significantly affected by the bonding system.<sup>26</sup>

The older silane coated brackets require a wrench type tool to be used with torsional or rotational force. Transcend 2000 mechanical retention brackets use a pistol grip debonding tool. This technique in removing ceramic material is least traumatic to the patients.<sup>27</sup>

Further, the ultrasonic technique requires increased debonding time, applying force levels possibly uncomfortable to patients with sensitive teeth, the potential for soft tissue injury, and a need for a water spray to avoid pulpal damage from heat build-up. When the bracket fractures, grinding with high-speed diamond bur is carried out, which is time-consuming, and the heat may affect the pulp and vitality of the tooth. Brackets with mechanical retention are fibrous, crusty, or dimpled. Polycrystalline brackets are more suitable for orthodontic use because their use does not drop dramatically following scratching. If load application tends to fracture CBs breaking the adhesive-bracket interface would minimize damage to the enamel surface.<sup>4</sup> The enamel surface quality before and after debonding with chemical retention also a cause for enamel damage.<sup>14</sup>

Thus, from the above review, it is clear that the enamel surface damage during debonding of CBs by different technique, though occur still it is a preferred choice for the practitioners due to its unique characteristics.

## CONCLUSION

The different literature reviews suggest that in debonding CBs, ligature cutter is the most superior technique compared to the other three methods since it takes the least time to debond the brackets with minimal enamel damage and residual adhesive remaining on the enamel surface.

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## REFERENCES

1. Jena AK, Duggal R and Mehrotra AK. Physical properties and clinical characteristics of ceramic brackets: a comprehensive review. Trends Biomater. Artif Organs 2007;20(2).
2. Karamouzou A, Athanasiou AE and Papadopoulos MA. Clinical characteristics and properties of ceramic brackets: a comprehensive review. Am J Orthod Dentofacial Orthop 1997;112(1):34-40.
3. Swartz M, Ceramic brackets. J Clin Orthod 1988;22(2):82-88.
4. Ghafari J. Problems associated with ceramic bracket suggest limiting use to selected teeth. Angle Orthod 1992;(2):45-152.
5. Storm ER. Debonding ceramic brackets. J Clin Orthod 1990;24(2):91-94.
6. Eliades T, Viazis AD, Lekka M. Failure mode analysis of ceramic brackets bonded to enamel. Am J Orthod Dentofacial Orthop 1993;104(1):21-26.
7. Bishara and Trulove. Comparisons of different techniques for ceramic brackets: An in vitro study. Part I. Background and methods. Am J Orthod Dentofacial Orthop 1990;98(2):145-153.
8. Boyer D, Engelhardt G, Samir E. Bishara. Debonding orthodontic ceramic brackets by ultrasonic instrumentation. Am J Orthod Dentofacial Orthop 1995;108(3):262-266.
9. Gwinnett J, Brook SA. Comparison of shear bond strengths of metal and ceramic brackets. Am J Orthod Dentofacial Orthop 1988;93(4):346-348.
10. Scott F, Garcia-Godoy F. Shear bond strengths and effects on enamel of two ceramic brackets. J Clin Orthod 1993;27(2):83-88.
11. Redd TB, Shivapuja PK. Debonding ceramic brackets: effects on enamel. J Clin Orthod 1991;2 (8):475-481.
12. Zachrisson B, Arthun J. Enamel surface after various debonding procedures. Am J Orthod 1979;75(2):121-137.
13. Bishara SE, Fonseca JM, Boyer DB. The use of debonding pliers in the removal of ceramic brackets: Force levels and enamel cracks. Am J Orthod Dentofacial Orthop 1995;108(3):242-248.
14. Kitahara-Ceia FMF, Mucha JN and dos Santos PAM. Assessment of enamel damage after removal of ceramic brackets. Am J Orthod Dentofacial Orthop 2008;134:548-555.
15. Oliver RG. The effect of different methods of bracket removal on the amount of residual adhesive. Am J Orthod Dentofacial Orthop 1988;93(3):196-200.
16. Sylvester E. Clinical Aid Thermal Debonding of ceramic bracket. J Clin Orthod 1991; 25 (12):748-32.
17. Scott GE. Fracture toughness and surface cracks. Angle Ortho 1988;1:5-8.
18. Zachrisson BU, Skogan O, Hoymyhr S. Enamel cracks in debonded, debanded, and orthodontically untreated teeth. Am J Orthod Dentofacial Orthop 1980;77:307-319.
19. Diedrich P. Enamel alterations from bracket bonding and debonding. Am J Orthod Dentofacial Orthop 1981;79(5):500-522.
20. Sheridan JJ, Brawley G and Hastings J. Electrothermal debracketing. Part I. An in vitro study. Am J Orthod Dentofacial Orthop 1986;89(1):21-27.
21. Krell KV, Courey JM, Bishara SE. Orthodontic bracket removal using conventional and ultrasonic debonding techniques, enamel loss, and time requirements. Am J Orthod Dentofacial Orthop 1993;103 (3):258-266.
22. Scott GE. Fracture toughness and surface cracks. Angle Ortho 1988;1:5-8.
23. Britton JC, McInnes, Weinberg R, Ledoux, Retief DH. Shear bond strength of ceramic orthodontic brackets to enamel. Am J Orthod Dentofacial Orthop 1990;98(4):348-353.
24. Flores DA, Caruso JM, Scott GE, Jeiroudi MT. The fracture strength of ceramic brackets: a comparative study. Angle Ortho 1990;4:269-276.
25. Habibi M, Hosseinzadeh Nik T, Hooshmand T. Comparison of debonding characteristics of metal and ceramic orthodontic brackets to enamel: an in-vitro study. Am J Orthod Dentofacial Orthop 2007;132:675-679.
26. Vukovich ME, Wood DP, Daley TD. Heat generated by grinding during removal of ceramic brackets. Am J Orthod Dentofacial Orthop 1991;99(6):505-512.
27. Chaconas SJ, Caputo AA, Niu GSL. Bond strength of ceramic bracket with various bonding system. Angle Orthod 1991;1:35-42.
28. Sorenson N. Technique modifications to optimize ceramic bracket performance. J Clin Orthod 1991;25(7):439-441.



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### REVIEW PAPER

# Digital well being: implications of social media on adolescents

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### ABSTRACT

Social media and the internet have become a part of the daily life of children more so during the ongoing pandemic. Social media apart from being a platform for entertainment and communication has emerged as a mental health hazard. This paper reviews some published literature on the impact of social media on the health of children and young people. On the one hand, social media provides for cognitive and social development and on the other poses risk for potential problems like cyberbullying, Facebook depression, sexting, and exposure to inappropriate content. Here we discuss a few of the many problems that a child faces in incessant use of social media and provide a basic outline of what could be done to tackle this digital endemic.

**Keywords:** Child psychiatry; behavioral problems; general pediatrics; digital footprint; bullying; suicide.

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### INTRODUCTION

The internet or the World Wide Web has become a part of today's world, even more so during the pandemic, leaving people indoors with social media as the source of communication. Late childhood and adolescence is a critical time for social and emotional development. This life stage has been hugely affected by the universal adoption of the internet as a source of information, communication and entertainment. With the introduction of the internet at a tender age, the new generation of children and adolescents became the first group to use it on a large scale and among the first to experience problems associated with excessive internet use.<sup>1</sup>

Social media offers a collaborative space for social interaction between seemingly infinite numbers of people. Children and adolescents benefit by engaging in various forms of social

media, which enhances communication, social connection and technical skills. The internet is a research site for testing theories of technology diffusion and media effects capable of integrating modes of communication. Social media sites such as Facebook and Instagram offer multiple daily opportunities for connecting with friends, classmates and people with shared interests. Several benefits have been identified about the routine use of social media platforms. "The six key overarching benefits were identified as (1) increased interactions with others (2) more readily available, and tailored information, (3) increased accessibility and widening access to health information, (4) peer, social, emotional support, (5) public health surveillance, and (6) potential to influence health policy."<sup>2</sup>

Social media can be used in several ways, like online profile, texting, walls and boards for posting content, online dating,

and blogging. John and MacArthur, in their article, concluded that 75% of teenagers own cell phones and 25 percent use them for social media, and 24 percent use them for instant messaging.<sup>3</sup> The above submission shows that much of this generation's social and emotional development occurs on the internet and cell phones. Adolescence is a period of transition between childhood and adulthood. During this period, identity, peer relationship, sexuality, and self-esteem evolve. A novel transformation is noted in manners of communication and the establishment of relationships. Weiser conducted studies and concluded that that people's interaction online shaped their offline way of living.<sup>4</sup> Other problems associated with social media awareness include internet addiction and sleep deprivation.<sup>5</sup>

### Facebook depression

The term 'Facebook depression' was coined in 2011 in an article that examined the effect of social media on young people.<sup>6</sup> A recent study concludes that 'daily overuse of various forms of media and technology harms the health of all children, preteens, and teenagers, which in turn, makes them more prone to psychological disorders like anxiety and depression.'<sup>7</sup> Social media sites like Facebook and Instagram are based on the idea of sharing pictures. Children share photos that they deem perfect for the site. Acceptance by and contact with peers is an essential element of adolescents' life. If the response to such upload is not as per expectation, it leads to depression and self-doubt. These over a while may lead to full-blown depression and anxiety issues. An interview-based study conducted with high school students found a statistically significant correlation between time spent on social networking and participant scores on the Beck Depression Inventory. It concluded that depression and online social networking were related.<sup>8</sup>

As with offline depression, teens who suffer from Facebook depression are at risk for social isolation and sometimes turn to questionable sites that may promote substance abuse, unsafe sexual practices or self-destructive behaviours. A study of risk-taking behaviour found that the key determinant was the person's nature, where Facebook enhanced feelings of connectedness for well-adjusted people. Still, those prone to depression were likely to feel more disconnected.<sup>9</sup>

### Cyberbullying and online harassment

Cyberbullying is deliberately using digital media to communicate false, embarrassing or hostile information about another person. Online harassment is often used interchangeably with the term "cyberbullying". For some, the appeal of cyberbullying comes from the anonymity of the attack. It can lead to short- and long-term negative social, academic, and health issues for both the bully and the target. It causes profound psychological outcomes, including depression, anxiety, severe isolation, and suicide.<sup>6,10</sup> A survey by Kwan and Skoric examined cyberbullying among students aged 13–17 years in Singapore. They concluded that social

media is just another channel through which playground bullying now reaches the home.<sup>11</sup> The study 'Cyberbullying and the Digital Self' presents a case study of a cyberbully victim who, following her parent's insistence, deleted her Facebook account, went on to commit suicide 'as if the death of her online persona foreshadowed her death'. The case study provides an example where the 'digital or online self' is an extension of the actual self, implying that it is not as easy as not logging on or just turning off the computer for victims of cyberbullying.<sup>12,13</sup>

### Online risk-taking behaviour

Young people on social media sites are more prone to risk-taking behaviour that may place their health at risk. A study by MA Moreno of 500 publicly viewable MySpace profiles showed 54% of young people displayed risk behaviour.<sup>9</sup> In some cases, online risk-taking behaviour can lead to cyberbullying, as in the tragic case of Amanda Todd that resulted in suicide. What started as a one-off incident in the year in an online chat room where a man convinced her to expose herself turned nasty when the man threatened a year later via Facebook to disclose her photos if she did not reveal more. Amanda was unable to escape from being victimized.<sup>14</sup> Other notorious examples exist, such as Jessi Slaughter, the Internet alias of an 11-year-old girl who used YouTube to disparage others and subsequently fell victim to the abuse of those she had slandered.<sup>15</sup> A poll showed that half of the cases, aged 13-18 years often communicate through the internet with someone they have not met in person. One third has talked about potentially meeting face to face. Some have endangered their lives, like the case of Cynthia Osokogo, where her Facebook friend raped and strangled her to death in a hotel room in Lagos, Nigeria, on the first face to face encounter for a business deal.<sup>16</sup> The problems on social media are not only sexual but also includes deceptive marketing policies and identity thieves. They thrive on the digital footprint of the children and their posts daily.

### Distorted sense of reality

Media sites are constantly using their digital footprint to manipulate children. Many social media sites display multiple advertisements such as banner ads, behaviour ads that target people based on their web-browsing habits and demographic-based ads that focus people based on a specific factor such as age, gender, education, marital status, etc. It influences not only the tendencies of adolescents but also their views on what is expected. The content portrayed on social media and the internet often isn't actual, leading kids to believe in false realities. Pictures that are edited to look flawless and influencers who always seem to be on vacations and always at best of themselves every time can be highly damaging to kids when they're growing up and figuring out their self-identity and detrimental to their psychological development.

### Self-esteem and well-being

Social support is defined as the perception that someone is

being cared for. With the advent of the internet, this support system is lost in the fog of the online persona. Spending countless hours on the internet, children spend minimal time with family and friends. They miss out on real-life interaction, which results in distorted social skills leading to social isolation. They end up alone as they fail to develop any meaningful relationship. A randomized controlled trial of university students exposed to one of three conditions (their own Facebook profile, a mirror or a control group) found that self-esteem was highest when students viewed or updated their own Facebook profile. This result is attributed to the participant's ability to selectively self-present by choosing their best photo or personal information in creating their Facebook profile.<sup>17</sup>

When the children start to gain self-identity and psychosocial growth, any negative ideas and comments on their online persona can trigger depression and self-doubt. Tiggemann and Slater demonstrated a link between social media and body image concerns in a large study involving 1087 girls aged between 13 and 15 years. The study also showed a relationship between the number of online friends and worries about body image.<sup>18</sup> Another study concluded as 'self-esteem was negatively related to the frequency of status updates, Facebook intensity and update intensity, suggesting that the more frequently people go on Facebook and update their status and the more meaning they attribute to having Facebook/status updates in their lives, the lower their self-esteem.'<sup>19</sup>

## CONCLUSION

Technology is a privilege and must not be allowed to hamper life in any way. Nothing on the internet goes unnoticed, and even a tiny mistake of uploading a risqué photo to a distasteful "joke" can come back to haunt in terms of future job opportunities, relationships, and general well-being. Parents need to tell the children the consequence of posting such content online and understand why they must refrain from uploading questionable material. Children need to know that it's entirely unacceptable to cultivate relationships with strangers online, and even more dangerous is hiding an online connection from their parents. Parents need to tell their kids that they are essential to the parent if someone is important to them, no matter where the child meets them. Cultivating a sense of security at home and making it comfortable for children to open up to their parents about their actual events is of utmost necessity. Ensuring communication lines are always open and having children use their device in a public space where they can parent over their shoulders from time to time are potentially more effective strategies than "following" their social accounts.

We must always be on the lookout for changes in children's behaviour. Difficulty sleeping, nervousness, and an unwillingness to go to school may be signs of being cyberbullied or having some problems. Parents must talk with them and never turn a blind eye, hoping they will figure it out

themselves. It is the need of the hour to remind children that they are being loved and cared for at home and making sure that they can recognize inappropriate behaviour. Social media is a necessary evil and is here to stay. Although social media can positively impact the health and well-being of children, it can also pose risks for these vulnerable populations. These risks can be minimized by appropriate website design, identifying those most at risk, and developing strategies to help them manage these risks. There is insufficient research in this area, particularly regarding the impact of social media on younger children in India. From this review, we hope to formulate a proper study design to get a clearer picture of social media risks in children in India and formulate new strategies to tackle the existing problems related to it.

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## REFERENCES

1. Subrahmanyam K, Greenfield PM, Tynes B. Constructing sexuality and identity in an online teen chat room. *J Appl Dev Psychol* 2004 Nov 1;25(6):651-66.
2. Moorhead SA, Hazlett DE, Harrison L, Carroll JK, Irwin A, Hoving C. A new dimension of health care: systematic review of the uses, benefits, and limitations of social media for health communication. *JMIR* 2013;15(4):85.
3. Richards D, Caldwell PH, Go H. Impact of social media on the health of children and young people. *J Paediatr Child Health* 2015 Dec;51(12):1152-7.
4. Weiser EB. The functions of internet use and their social and psychological consequences. *CyberpsycholBehav Soc Netw* 2001 Dec 1;4(6):723-43.
5. Dfc intelligence forecasts video game market to reach \$57 billion in 2009. [Online]. 2008 July 8 [cited 2008 Dec 17]; Available from: URL:<http://www.gameinforwire.com/news.asp?nid=12446>
6. O'Keeffe GS, Clarke-Pearson K. The impact of social media on children, adolescents, and families. *J Am Acad Child Adolesc Psychiatry* 2011 Apr 1;127(4):800-4.
7. Atwal A. Youth today: Social media use can lead to mental health problems. [Online]. 2011 August 10 [cited 2013 Oct 25]; Available from: URL:<https://youthtoday.org/2011/08/social-media-use-can-lead-to-mental-health-problems>
8. Pantic I, Damjanovic A, Todorovic J. Association



- between online social networking and depression in high school students: Behavioral physiology viewpoint. *Psychiatr Danub* 2012;24:90–3.
9. Moreno MA, Parks MR, Zimmerman FJ, Brito TE, Christakis DA. Display of health risk behaviors on myspace by adolescents: prevalence and associations. *Arch Pediatr Adolesc Med* 2009;163: 27
  10. Le Heuzey MF. Social media, children and pediatricians. *Arch Pediatr* 2012;19:92–5.
  11. Kwan GCE, Skoric MM. Facebook bullying: an extension of battles in school. *Comput Human Behav* 2012;29:16–25.
  12. Al-Alosi Hadeel. The role of bystanders in cyberbullying. [Online]. 2016 January [cited 20 Oct 20]; Available from: URL: <https://search.informit.com.au/documentSummary;dn=848307412422141;res=IELHSS>
  13. Sivashanker K. Cyberbullying and the digital self. *J Am Acad Child Adolesc Psychiatry* 2013;52:113–15.
  14. Hamm MP, Newton AS, Chisholm A, Shulhan J, Milne A, Sundar P, et al. Prevalence and effect of cyberbullying on children and young people: a scoping review of social media studies. *JAMA Pediatr* 2015 Aug 1;169(8):770–7.
  15. Crosslin K, Golman M. “Maybe you don’t want to face it”– college students’ perspectives on cyberbullying. *Comput Human Behav* 2014 Dec 1;41:14–20.
  16. Undiyaundeye F. Impact of social media on children, adolescents and families. *Global Journal of Interdisciplinary Social Sciences* 2014;3(2):1–4.
  17. Gonzales AL, Hancock JT. Mirror, mirror on my Facebook wall: Effects of exposure to Facebook on self-esteem. *Cyberpsychol Behav Soc Netw* 2011;14:79–83.
  18. Tiggemann M, Slater A. NetGirls: The Internet, facebook, and body image concern in adolescent girls. *Int J Eat Disord* 2013;46:630–3.
  19. Hawi NS, Samaha M. The relations among social media addiction, self-esteem, and life satisfaction in university students. *Social Science Computer Review* 2017 Oct;35(5):576–86



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### RAPID COMMUNICATION

# Use of fingerprint biometric in the workplace during COVID times: a critical viewpoint

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Recognition of a person based on his or her physiological characteristics is known as Biometrics. Biometric systems have been widely used before the inception of computers in human activities. These systems make use of the physical or biological traits of human beings for recognition and authentication purposes. The most commonly used natural features or characteristics are fingerprints, iris, and face. Before the COVID-19 pandemic, most educational institutions, IT companies, Government and private offices used biometric fingerprint systems to mark attendance or access into restricted areas. Fingerprint recognition is a secure and convenient technology that has become common and widespread, not only in the workplace, smartphones, but also in our daily activities. However, the recent global outbreak of COVID-19 concerns the safety of fingerprint authentication, as touching the sensors can potentially spread viruses. In addition, surfaces in general public places such as supporting handles in buses and trains, elevators buttons, ATMs, door handles, etc., can act as fomites for spreading the virus. In the wake of the COVID-19 outbreak, numerous news articles have claimed the risk of spreading the infection via these commonly touched surfaces. In this paper, we discuss the actual risk of transmission of COVID-19 through fingerprint biometrics and explore alternative biometric methods which can be used during the COVID-19 pandemic.

**Keywords:** Biometric; fingerprint; COVID-19.

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## INTRODUCTION

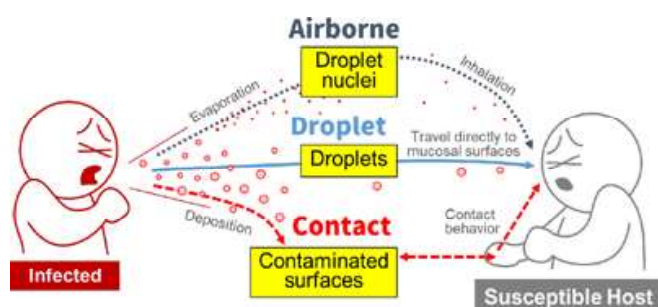
Fingerprint recognition is a secure and convenient technology that has become common and widespread, not only in smartphones but in our everyday lives as well.<sup>1</sup> Biometric time clocks have become increasingly popular among many organisations as they heighten security and add convenience.<sup>2</sup> Coronavirus disease 2019 (COVID-19) is a potentially severe acute respiratory infection caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2).<sup>3</sup> On March 11, 2020, WHO (World Health Organization) declared the COVID-19 outbreak as a Pandemic.<sup>4</sup> The clinical presentation is that of a respiratory infection ranging from a mild common cold-like illness to severe viral pneumonia leading to acute respiratory

distress syndrome that is potentially fatal.

The three possible modes of transmission, (as shown in **Figure 1**) of the virus recognised are suspended particles (bioaerosols), droplets, and surface contact.<sup>5</sup>

It can get transmitted through direct or indirect contact of a healthy individual with a COVID-19 infected individual through his secretions like saliva or respiratory droplets released during coughing, sneezing, or talking. The size of respiratory droplets is usually larger than 5 µm, and thus, they tend to settle down after travelling a short distance of 1-2 meters in a short time.<sup>6</sup>

Even during this pandemic situation, many institutions are



**Figure 1** Modes of Transmission from Exhaled Pathogens [Adapted from a leaflet of the Office of the Prime Minister and the Ministry of Health, Labour and Welfare of Japan (2020)]<sup>5</sup>

compelling their employees to use fingerprint biometric for attendance. This process has created panic among the employees as there are reports which say that the virus can be transmitted through this process. The Administration/HR (Human Resource) department is concerned about using the fingerprint biometric system or shifting to any other alternative methods.

This paper discusses the actual risk of transmission of COVID-19 through fingerprint biometrics and explore alternative biometric methods which can be used during the COVID-19 pandemic.

## MATERIAL AND METHODS

The present work is done in the Department of Forensic Medicine and Toxicology, AIIMS (All India Institute of Medical Sciences), Bibinagar, Hyderabad. We reviewed the scientific papers published about the transmission of SARS-CoV and SARS-CoV-2 in standard search engines and gathered information regarding the survival period of the virus & other relevant things needed for this paper.

## VIABILITY OF THE VIRUS

Van DN et al.,<sup>7</sup> reports the survival of both SARS-CoV and SARS-CoV-2 of up to 2 days (on surfaces) and three days (in aerosols generated in the laboratory). Many other studies were done in the lab, including Rabenau HF et al.,<sup>8</sup> (6 days), Duan SM et al.,<sup>9</sup> (4 days), Warnes SL et al.,<sup>10</sup> (5 days), have similar findings. Dowell SF et al.,<sup>11</sup> tried to mimic actual conditions in which a patient might contaminate a surface; no viable SARS-CoV was detected on surfaces.<sup>7-11</sup>

The viable virus can be found on contaminated surfaces for periods ranging from hours to days, depending on the environment (including temperature and humidity) and surface type. In experimental studies, at 40% relative humidity and 21-23°C, SARS-CoV-2 was detectable for:

- Up to four hours on copper;
- Up to 24 hours on cardboard;
- Up to two to three days on plastic and stainless steel.

Other experiments suggest that increasing temperature and relative humidity accelerates virus inactivation on surfaces. For example, the rising temperature to 35°C reduces the virus's half-life on non-porous surfaces to 1.0 to 8.9 hours from 6.3 to 18.6 hours at 24°C.<sup>12</sup> Thus, while SARS-CoV-2 can be very stable in favourable environments of lower temperatures (4°C) and humidity, it is highly susceptible to standard disinfection methods.<sup>13</sup>

## HOW SAFE THE FINGERPRINT AMID COVID PANDEMIC

The Global outbreak of COVID-19 has raised questions about the safety of using fingerprint authentication, as touching the sensors can potentially spread viruses. Various studies have shown very little chance of SARS-CoV-2 getting transmitted through contact, as many factors are involved. Though studies conducted in laboratories claim that the virus can remain viable over the surfaces for 2 days to 6 days,<sup>7-10</sup> the study done in real-life scenarios did not support this.<sup>11</sup>

Respiratory secretions or droplets expelled by infected individuals can contaminate surfaces like the fingerprint scanner, ATM sensors, door handles in buses, parks, etc. Thus, there is a possibility that a person can get COVID infection by touching a surface or an object that has the infectious virus on it and then touching their mouth, nose, or possibly their eyes. Transmission risk then depends on several factors, including the concentration of viable virus deposited and its viability on a specific surface for a given period. It should be noted that people who come into contact with potentially infectious surfaces often also have close contact with the contagious person, making the distinction between the respiratory droplet and fomite transmission challenging to discern.

On March 5, 2020, Delhi Government announced the suspension of biometric attendance in its offices. The Government of India, too, announced a similar measure where Biometric attendance was suspended in all its offices. Soon SAI (Sports Authority of India), NGT (National Green Tribunal), Goa, Maharashtra, Punjab, and many other state governments switched off biometric attendance systems.<sup>14</sup> Even though most Government-run Institutions have suspended the use of fingerprint biometric in their offices, many private Institutions still insist their employees give their attendance through fingerprint biometric.

## CONCLUSION

After going through all the information and scientific data, we conclude that it is better to avoid using Fingerprint biometric system in the workplace during the COVID pandemic. Amongst the other alternative options available, the best option is Iris Scan. However, in places where fingerprint biometrics cannot be avoided, the sanitisation of hands before and after use can be advocated.

**Author contribution:** We declare that this work was done

by the authors named in this article. The authors will bear all liabilities about claims relating to the content of this article.

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## REFERENCES

1. Diksha D. Covid-19 to give rise to non-contact biometric attendance [Online]. 2020 April 27 [Cited 2021 April 10]; Available from: URL:<https://www.biometricupdate.com/202004/using-fingerprint-recognition-under-covid-19>
2. Yasmeen Q. Fingerprint scanners are risky amid coronavirus pandemic [Online]. 2020 March 20 [Cited 2021 April 11]; Available from: URL:<https://www.workforce.com/news/fingerprint-biometrics-poses-risk-to-employees-amid-coronavirus-pandemic-its-a-touchy-subject>
3. Ren LL, Wang YM, Wu ZQ, et al. Identification of a novel coronavirus causing severe pneumonia in human: a descriptive study. *Chin Med J (Engl)* 2020 May 1;133(9):1015-24.
4. WHO Director-General's opening remarks at the media briefing on COVID19 -March 2020.
5. Prime Minister's Office," Let's Avoid These Three Conditions When We G Out!" Flyer (in Japanese), <https://www.kantei.go.jp/jp/content/000061234.pdf> (retrieved March 21, 2020).
6. Virus in the air: preventive measures [Online]. 2020 [Cited 2021 April 10]; Available from: URL:<https://www.ccmb.res.in/docs/Advisory-air-sample-study.pdf>
7. Van DN, Bushmaker T, Morris DH, et al. Aerosol and surface stability of SARS-CoV-2 compared with SARS-CoV-1. *N Engl J Med* 2020;382:1564-67.
8. Rabenau HF, Cinatl J, Morgenstern B, Bauer G, Preiser W, Doerr HW. Stability and inactivation of SARS coronavirus. *Med Microbiol Immunol* 2005;194:1-6.
9. Duan SM, Zhao XS, Wen RF, Huang JJ, Pi GH, Zhang SX. Stability of SARS coronavirus in human specimens and environment and its sensitivity to heating and UV irradiation. *Biomed Environ Sci* 2003;16:246-55.
10. Warnes SL, Little ZR, Keevil CW. Human coronavirus 229E remains infectious on common touch surface materials. *mBio* 2015;6:e01697-15.
11. Dowell SF, Simmerman JM, Erdman DD, et al. Severe acute respiratory syndrome coronavirus on hospital surfaces. *Clin Infect Dis* 2004;39:652-57.
12. Biryukov J, Boydston JA, Dunning RA, Yeager JJ, Wood S, Reese AL, et al. 2020. Increasing temperature and relative humidity accelerate the inactivation of SARS-CoV-2 on surfaces [serial online]. 2020 [cited 2021 April 11] *mSphere* 5:e00441-20. Available from URL:<https://doi.org/10.1128/mSphere.00441-20>
13. Alex W H Chin, Julie T S Chu, Mahen R A Perera, Kenrie P Y Hui, Hui-Ling Yen, Michael C W Chan, Malik Peiris, Leo L M Poon. Stability of SARS-CoV-2 in different environmental conditions. *The Lancet Microbe* 2020 May;1(1):e10.
14. Diksha D. Say No to the biometric attendance system to prevent Coronavirus [Online]. 2020[Cited 2021 April 10]; Available from: URL:<https://cio.economictimes.indiatimes.com/news/corporate-news/say-no-to-the-biometric-attendance-system-to-prevent-coronavirus/74767213>



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